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The contract for the construction of the Holland submarine torpedo boat has been signed by Secretary Herbert, of the U. S. Navy Department. The inventor is John P. Holland, who, in 1893, succeeded in having an appropriation of $200,000 made by Congress for this purpose. The boat, which is now to be built, will be 135 ft. long and 9 ft. deep, and will be built of steel, with armored protection. It will be pointed at both ends, and be nearly cylindrical in section. A speed of 13 knots on the surface and 8 knots submerged is claimed. Mr. Holland claims that he can shut down the smokestack, seal the openings and sink to a depth of 50 ft. in four seconds. The motive power will be furnished by two triple-expansion engines, and a crew of 18 men will be required. Two horizontal rudders will control the descent and ascent of the boat.

The Brooklyn dry-dock contract of Mr. John Gillies is for a third time in danger of being cancelled by the Secretary of the Navy. This contract was made on Nov. 17, 1892, calling for the completion in 27 months of a timber dry-dock 600 ft. long for the sum of $412,-000. On June 16, 1893, the dock was lengthened to 670 ft. for an additional payment of $16,556, and an allowance of three months' more time; and a later change in plan involved $5,000 more compensation and two months' more time. The total time limit was thus 32 months from Jan. 1, 1893, when Gillies was put in possession of the site, and a total contract price of $463,556 was agreed upon. Progress upon the dock was so slow that about a year after the dock was commenced Commander P. F. Harrington, U. S. N., was ordered to investigate conditions, and recommended the annulment of the contract, and the Chief of the Bureau of Yards and Docks agreed with him. Mr. Gillies, however, held on until the fall of 1894, when Civil Engineer M. T. Endicott, U. S. N., was sent by the Secretary to examine the work and again reported little material progress. Mr. Gillies was sent for and made such explanations to Secretary Herbert that he was permited to proceed. He is now again called up to explain why only about 20% of his work is done, with only a few months of his time limit left him.

A 10-ft. water-works intake tunnel for Buffalo, 5,100 ft. long, beneath Lake Erie, and two new 30,000,000-gallon pumping engines, with boilers, building and necessary force mains, have just been recommended by a special committee in a report to the city council. Besides the above work, the committee further advises the enlargement of the present river intake tunnel, and an extension by means of pipes to an intake in clearer water; also a new 30,000,000-gallon triple-expansion pumping engine and four new boilers at the present pumping station, and other minor improvements. The estimated cost of the work recommended is about $1,000,000.

A Paving Exposition was opened on April 4 at Minneapolis, under the auspices of the Minneapolis Commercial Club. The exhibition included paving material, processes of manufacture and actual demonstrations of methods of laying pavement. The exhibits, about 30 in number, included asphalt, cements, granite, sandstone, cedar block and a variety of paving bricks. The granite men were first in point of number, and the pressed and vitrified brick men came next.

The new cable for the Columbus Ave. line of the Metropolitan Traction Company, in New York, is 1½ ins. in diameter, is about 6 miles long and weighs 65 tons. It was brought from Wilkes Barre, Pa., over the Pennsylvania R. R., and was ferried across the Hudson to the foot of 44th St. It was drawn to its destination at Sixth Ave. and 50th St. on a 10-ton specially-designed iron truck pulled by 42 horses. The best paved streets were selected and no damage was done.

An ordinance compelling trolley cars to slow down to three miles an hour before crossing all streets of 20 ft. in width or over, under a penalty of $25 for each offence, was recently passed by the town council of Media, Pa. We are informed, however, that the ordinance is not enforced.

The most serious railway accident of the week was a derailment on the Chicago & Alton R. R., near East Alton, Ill., April 5. As a southbound freight train was crossing Wood River bridge the engineman applied the brakes on account of the down grade. An empty flat car in the middle of the train jumped the track owing to the pressure of the heavy cars in front and behind, and 14 cars went over the bridge, carrying away a part of the structure. A number of laborers from the Chicago Drainage Canal were on the train, and 4 men were killed, 2 fatally injured, and several others more or less injured.——Another serious accident was the derailment of a freight train on the Buffalo, Rochester & Pittsburg R. R., between Punxsutawney and Big Run, Pa., on April 9. The train ran into a washout and the engine and 18 empty gondola cars were wrecked. The engineman and fireman were killed and a brakeman seriously injured.——A third serious accident was the derailment of a southbound express for Boston on the Boston & Maine R. R., near Smith's Mills, Que., April 8. The train struck some large bowlders which had fallen near the end of a cut, and the engine and tender went down the bank. The engineman and fireman were killed.

A car of a westbound passenger train on the Bellaire, Zanesville & Cincinnati R. R. (3 ft. gage) was derailed just before reaching a trestle crossing a small stream on a curve at Whigville, O., April 5. The derailed car pulled the engine off the track, and the trestle collapsed. The engineman and fireman were killed.

Two five-story business buildings on Main St., at Wheeling, W. Va., collapsed April 9, about 8 a. m., burying about a dozen men in the ruins, after which the wreckage caught fire. Six persons were killed and four were injured. One of the buildings is said to have been weakened by the addition of two stories, and to have carried down, in its fall, the adjoining building.

A fire-damp explosion in the Blue Canyon coal mine at Lake Whatcom, ten miles from New Whatcom, Wash., caused the death of over 20 men.

An explosion of powder occurred in a ship-chandler's store at Decatur and Ursulines Sts., New Orleans, La., about 2 a. m., April 5, completely wrecking the building. Five persons were killed and five injured.

Floods and freshets are occurring in several parts of New York state, doing considerable damage to property and washing out several small bridges and dams. Along the Delaware River the floods are said to be 10 ft. higher than for 17 years past.

The head collision on the Maine Central, noted last week, appears to have been due to the lapse of memory of a train despatcher, or, more properly speaking, to the use of a system of moving trains which places far too great reliance on a single fallible human memory. According to the testimony before the State Railroad Commission, which investigated the accident, it is customary on the Maine Central for despatchers to order a blue flag or train order signal displayed at a station and then to postpone the actual giving of the order to some more convenient season. The despatcher who caused the wreck testified:

> It is customary when issuing several orders to save time in repeating the order by holding the train having the right of way at some point near at hand by the use of the blue flag. When practicable, it is the rule to give double orders, but in a good many instances the blue flag is used instead. . . . . We frequently find a blue flag out, and have to look the book over to find the order showing why it has been put out. No record is kept of the blue flags, and the only way of finding out why a flag has been ordered is to examine the book.

Under cross-examination the despatcher admitted that he had violated the rule requiring orders to be transmitted first to the train having the right of way, and also that the rule requiring the giving of duplicate orders had been repeatedly violated by him. In addition to these violations of the rules he had failed to notify the despatcher who relieved him for what purpose he had ordered the blue flag out at a certain station, forgetting momentarily himself which train it was put out to protect.

A three-car passenger train without angle-cocks on the brake-pipes has been running for over a year on the Michigan Central R. R. In place of the dummy coupling a simple blind coupling is used, with a finished face that makes an air-tight joint with the hose when connected. It is made of malleable iron and galvanized to prevent rusting. According to the "Railroad Gazette," Mr. J. A. Chubb, the Superintendent of Air-brakes, is pleased with the test, and claims that no more delays are necessary in releasing brakes when taking up or setting out cars or changing engines than are necessary with ordinary angle cocks, provided that with the latter all precautions in the way of testing brakes are taken that are prescribed by the rules. Flying switches cannot be made by a train without angle-cocks; but many railway officers would count this an advantage rather than a detriment.

The Standard Telephone Co., of New York, is a new organization, which, if all things are true that are claimed for it, will revolutionize the telephone business in the United States. Rumor places among its promoters the Sugar Trust, Standard Oil Company, the Pullman interests, etc. The capital of the parent company is $10,000,000. The interesting point, however, is the promised uniform rate of $25 per annum for telephones. The electrical devices to be used include those of Allen T. Nye and a number of others. The Standard Company has offices at 68 Broadway, New York, and the president is Mr. Thurlow Weed Barnes. Among the directors named are J. G. Brill, of Philadelphia; George Crocker, San Francisco; Charles T. Strauss, New York, and other prominent business men. One of the directors is Mr. Allen T. Nye, put down as "promoter of the company." State companies are being organized, with millions of capital (on paper, at least); and, according to press accounts, the Standard Telephone Co. is being "promoted" for all it is worth.

A permanent building exhibition is to be established at Buffalo, N. Y., by the Builders' Exchange Association, somewhat on the plan of the Demarest exhibitions in Brooklyn, Chicago, and other cities.

The Machinery Building at the Cotton States & International Exhibition, at Atlanta, Ga., will have a basement 8 ft. deep, through which will extend lengthwise of the building three main lines of shafting, from which power can be taken off to countershafts and upward through the floor at any desired point. In this way all overhead belts and countershafts will be avoided. About 4,000 HP. of engines will be shown, and an effort will be made to have these representative of the latest and standard types. A number will be directly connected to electric generators, while others will drive the main shafts, from which power will be conveyed to the various points of application by various methods of belting, rope drives, electrical transmission, etc. An effort will be made to show in this department working exhibits, showing processes, methods of operation, and the manner of application of tools, apparatus, etc. The boiler house will contain 5,000 HP. of water-tube boilers, consisting of ten batteries of two boilers each. The boiler room will be equipped with all modern appliances, such as mechanical stokers, and conveyors for handling both coal and ashes. The fuel used will be bituminous coal. Mr. J. H. Allen is Chief of the Machinery Department.

The Pease patent split-tube and concrete construction, for use in columns or floors, is being introduced into England. Strips of iron, steel, phosphor bronze or other metal are bent into a tubular shape by special machinery, with edges left sufficiently far apart to allow two thicknesses of the same metal, to enter. These split tubes can then be assembled, in layers of one or more diameters, so as to form floors or columns; the edges of one or more tubes entering the slots and connecting the tubes together. The tubes are then filled with concrete. A strip 11 ins. wide, made of two parallel layers of interlacing 2-in. iron tubes, 1-45 in. thick, supported 17½ tons, on end, without buckling; and a strip of the same width, made of 2-in. tubes of No. 8, B. W. G., carried one ton per sq. ft.

SPECIFICATIONS FOR STREET LIGHTING BY ARC LAMPS.

We discussed editorially in our issue of March 14 the proper basis on which contracts for street lighting by arc lamps should be made. Since that article was published, we have received from Mr. William Pierson Judson, M. Am. Soc. C. E., of Oswego, N. Y., a copy of the specifications under which arc street lights are now furnished to Oswego. As this matter is of so much practical interest at the present time, we reprint herewith the specifications, prefacing them by Mr. Judson's letter, as follows:

Sir: Under the heading "The Candle Power of Arc Lamps" the Engineering News of March 14, 1895, stated very fully the difficulties under which many cities have sought light, and in many cases have paid for it without finding it. The accompanying specifications may be of interest in this connection, as they were intended to meet these difficulties.

In August, 1894, these specifications were made by the writer while acting as consulting engineer to the Board of Public Works of Oswego, N. Y. It may be objected that no responsible company would make a contract on such terms at a reasonable rate. The Oswego contract was taken under these specifications by the same company which had lighted the city during the preceding five years, during which time nothing definite had been required or furnished. The 1895 rate was $81 per arc lamp per year, or $6 per year less than under the 1890 contract. Yours truly,

Wm. Pierson Judson, M. Am. Soc. C. E.

Oswego, N. Y., March 20, 1895.

Specifications.

Number and Character of Lights.—The proposals will be made, at stated prices per lamp per annum, to install, maintain and operate 195 arc lamps of the capacity of 450 watts each; said lamps to be hung at the street intersections and on the bridges and as ordered. Separate price will also be stated, per lamp per annum, for supply of current and for the care of 190 incandescent 16-c. p. lamps, distributed in the city hall, engine houses, police stations, and other municipal buildings, as these are now wired or may in future be wired by the city.

Prices of Lights and Period of Lighting.—The price in each case will be a specified sum per lamp per annum, payable monthly. The street arc lamps are to be lighted during all of every night from dusk to dawn, and the incandescent lamps whenever needed in the regular course of municipal business.

Price to Include all Expenses.—Said sum to be specified as including all charges and expenses whatsoever incident to the execution of the provisions of the following specifications, and to the maintenance of a first-class lighting system to the satisfaction of the Board of Public Works of the City of Oswego, excepting only the salary of the Electrical Inspector, which shall be paid by the Board of Public Works.

Extensions to be Made.—It shall be agreed and provided that, in case the Board of Public Works shall see fit to extend and increase the lighting system beyond the number of lamps before specified, that said extensions of the lines and system shall be made as ordered, and that for each increase of five arc lamps, the price per annum for each of the total number of arc lamps shall be the same as for the original 195 lamps. If the incandescent lamps are to be increased in number, the wiring in the municipal buildings only shall be at the expense of the city, but the incandescent lamps and all renewals thereof in any building and mains and the transformers outside of the buildings shall be at the expense of the electric light company.

Proposed Power and Apparatus Must be Described.—Each proposal shall state whether it is proposed to use water power (of which several powers are available) or steam power. The proposal will also state the type and the maker's name of the dynamos and lamps and lamp carbons which it is proposed to use.

Dynamos and Lamps.—The electrical station shall be equipped with dynamos whose capacity is equal to supplying 450 watts of electrical energy to the terminals of each arc lamp on the city circuits; additional allowance being made for the resistance of the lines and for any other resistance which may be in series with the lamps. In case private lamps or small motors should hereafter be permitted by the Board of Public Works to be supplied at the request of the contractor from the same circuit as the city lamps, proportionate increase shall be made by the contractor in the generating capacity.

Separate Circuits.—In no case shall any of the city lamp circuits be connected, directly or indirectly, to the street railway circuits, or to any other circuit or circuits, without the consent in writing of the Board of Public Works.

Arc Lamps and Carbons.—The arc lamps which are to be used and maintained during the life of this contract for street lighting shall be of a modern standard pattern of approved efficiency, of the size commercially known as 2,000 c. p., or 450 watts, and shall be described in the proposal.

The carbons which are to be used shall also be specified by the bidders, and shall be of one of the best grades in the market, of standard American commercial carbons, and shall be subject to approval as such by the Board of Public Works. If at any time during the life of this contract the Board of Public Works shall be satisfied that a better grade of carbons can be purchased, they shall have the right to require said better carbons to be used, without additional expense to the city. The electric light company shall make no change in the brand of carbons used, without due approval in writing by the Board of Public Works. If any change in carbons shall be made by the electric light company without such approval in advance by the Board of Public Works, then 10% shall be deducted from the amount to be paid for the period of such unauthorized use of different carbons, whether said carbons are actually inferior in quality or not.

Repairs and Maintenance.—The lamps and globes and reflectors shall be examined and cleaned daily, and shall be kept in a state of highest efficiency to supply the maximum amount of light from the specified amount of electrical energy.

Electrical Inspector.—The Board of Public Works shall, if it sees fit to do so, employ an Electrical Inspector, or may designate any person or persons an inspector, and may change such inspector or person or persons so designated at pleasure. The person or persons so designated shall be charged with the duties incident to the enforcement of the terms of these specifications and the requirements of this contract, and their decision or decisions, when approved by the Board of Public Works, shall be final. This inspector shall be on duty during all of every night, or as required, while the lamps are in operation, and shall receive and promptly investigate any complaints which may reach him from the police, or by telephone or otherwise, of lamps which are said to be defective in their service. He shall each day inform the electric light company, upon blank forms provided for the purpose, of such defects and deficiencies in the lamps and the service as he may have observed during the preceding night, and of the consequent deductions which he has made therefor, as hereinafter provided. The electric light company shall require its employees to give the inspector all facilities for the ready performance of his duties, and also to treat him courteously while so engaged, discharging, upon demand of the Board of Public Works, any employees who persist in obstructing him.

Electric Meters.—In order that the Electrical Inspector or other person designated to perform the duties of such inspector shall be able to readily determine the amount of current supplied to each one of the different circuits of city arc lights, electrical meters shall be so set and maintained by the contractor, at his or its expense, on each circuit at some convenient point within one mile of the city hall that the inspector can examine them and determine the current passing on each circuit at any time.

Painting Poles.—All electric light poles shall be painted as and when directed by the Board of Public Works.

City Rules and Regulations.—The contractor shall comply with all existing or future rules, regulations or ordinances of the Common Council or Board of Public Works in regard to methods of wiring, the use of streets, placing of poles, and the kind of poles placed therein, and the trimming or cutting of shade trees, whether on said streets or on private property. Underground wiring not to be required during the life of this contract.

Deductions.—In case that a less current is found on any or all of the circuits (after the circuit has been started an hour) than the specifications require for such circuit, allowing 450 watts for each arc lamp, as before provided, then proportionate deductions will be made from the amounts to be paid for the lights for the period of such deficiency—the inspector using discretion as to noting minor variations.

In the case of any arc lamp which the inspector shall find to work irregularly, after the circuit has been started one hour, and to give an interrupted light, he shall observe it closely for not less than a quarter of an hour, and longer if convenient. If it is found that the light is interrupted or markedly reduced during less than 60% of the period of observation, then such per cent. shall be deducted from the contract price of that lamp for that entire night.

If the observed interruptions exceed 60% the lamp shall be recorded as "out" for that night. If it is again defective during the next night, although the interruptions do not equal 25%, it will be recorded as "out" until so repaired as to give a perfect and uninterrupted light.

Such deductions shall be made without any regard to the causes of the deficiency in light—whether they result from lack of water power, or repairs to canal, or obstruction of water flow by ice, or from accidents to the generating machinery or system, or from any causes whatsoever. But deduction shall not be made for loss of circuit due to high winds when circuit is closed again within an hour.

Comparison with Standard Lamps.—In the case of any lamp or circuit of lamps which may be considered to give a less light than other lamps elsewhere in the city, or in case the entire system is thought by the Board of Public Works to be below the efficiency of the same nominal size of arc lamps in some other city, then comparison may be made by photometric measurements of the useful ray of the lamps which are thought to be deficient with the similar ray of those which are satisfactory; the photometric measurement being made, at points 100 ft. along the street from the lamp and 15 ft. below the lamp, of the ray which makes an angle of 9° below the horizontal. If this photometric comparison shall show the light or lights to be less than the light given by 450-watt lamps elsewhere, then such proportionate deduction shall be made for such deficiency as the Board of Public Works may determine of part or of all of the lights, until the defect shall be corrected.

Bonds and Penalty.—Satisfactory bonds in a penalty of not less than $5,000 will be required to secure the faithful performance of the contract, and the Board of Public Works shall have power to hold such bonds, and to cancel the contract in case it is not properly performed.

THE NEW STEEL AND MASONRY WATER-SUPPLY CONDUIT, ROCHESTER, N. Y.

With inset.)

The use of steel for large water-supply conduits is increasing rapidly of late. Early in 1892 the East Jersey Water Co. completed a 21-mile line of 48-in. and a 5-mile line of 36-in. riveted steel supply conduit for Newark, N. J.*

In 1892-4, a 54-in. riveted steel intake, about 6,500 ft. long, was laid in Skaneateles Lake by the city of Syracuse, N. Y., in connection with a new supply main of 30-in. cast iron, about 20 miles in length.**

During the past year, the city of Rochester, N.Y., finished laying about 26½ miles of 38-in. and 1,600 ft. of 60-in. riveted steel pipe, which, with some 12,000 ft. of 6-ft. brick conduit, partly in tunnel, comprises a second supply conduit from Hemlock Lake. A number of other cities, among which we may mention Cambridge, Mass., and Allegheny, Pa., are now laying or planning to lay large steel mains.

The Rochester work, aside from its magnitude, contains many points of interest and is especially notable for the use of a new pipe-coating, a baking japan varnish, invented by Prof. A. H. Sabin, Chemist for Edward Smith & Co., varnish manufacturers, of New York city. This process is described further on.

The Rochester water-works were built by the city in 1872-6, and are notable as being one of the very few systems in the United States which combine pumping and gravity supplies, distributed by separate mains. The direct-pressure system distributes Genesee River water for fire and industrial purposes through about 19 miles of mains, and the gravity system distributes Hemlock Lake water for domestic and other uses through 237 miles of pipe, the mileage given being for the close of 1894.

Hemlock Lake is about 29 miles south of Rochester, and 386 ft. above the general city level. At ordinary low water it has an area of 1,828 acres. Its average middle depth is 65 ft. Including its water surface, the lake has a drainage area of 43.05 sq. miles, a large proportion of which is steep and forest covered. The total resident population is about 1,600, or 37 per sq. mile, but the summer population is greater. Special sanitary protection of the lake is maintained by the city of Rochester,*** by means of a carefully operated pail system for removing all excreta from houses on the border of the lake, where most of the summer residences are. Canadice Lake, about 200 ft. higher, and two miles east of Hemlock Lake, has a water area of 648 acres, and a drainage area of 13.88 sq. miles, with a further drainage area of 5.49 sq. miles on its

* See Eng. News, Oct. 11, 1890; Aug. 1 and 8, 1892, and July 13, 1893.

** See Eng. News, June 15, 1893, and Dec. 13, 1894.

*** Eng. News, April 28, 1888.

outlet before the latter joins the Hemlock Lake outlet, about one-third of a mile below the foot of Hemlock Lake, and only slightly below its water level. Thus a drainage area of 20 miles can easily be added to the Hemlock Lake watershed, when the consumption demands it, making 63 sq. miles in all.

The original conduit from Hemlock Lake consisted of first about 9¾ miles of 36-in. wrought iron pipe and 18½ miles of 24-in. pipe, of which nearly three miles are of wrought iron, in two different sections. The wrought iron pipe has given excellent service, but the cast iron pipe has become so filled with tubercles as to greatly reduce its carrying capacity. Up to the fall of 1894, the chief engineer of the works states corrosion had caused only one leak in the wrought iron pipe, so far as known, and not a cent had been expended for repairs during the 19 years the pipe had been in operation. Leaks have occurred from time to time in the lead joints of the cast iron pipe.

In 1888 the storage reservoirs were so taxed as to make it evident that a new supply must be provided. Investigations and reports on a new supply were made from time to time by eminent engineers, and finally in 1890 it was decided to lay a new main from Hemlock Lake to the city. This work has been carried out with Mr. Emil Kuichling, M. Am. Soc. C. E., as Chief Engineer. We are indebted to Mr. Kuichling for the drawings from which the accompanying illustrations were made. The greater part of the following text is abstracted from a paper by Mr. Kuichling, recently read before the Rochester Academy of Science and Chamber of Commerce, and the engineering students of the School of Mines of Columbia College. This matter has been supplemented by notes and observations made by a member of the editorial staff of this journal on a trip over the work last fall.

The location of Hemlock Lake, the old and new conduits, and the two reservoirs connected with the supply, is shown by the map, Fig. 1, on the inset. A profile of the pipe line is shown by Fig. 2.

The water is taken from a submerged crib, passes through a 60-in. steel intake, about 12,000 ft. of brick conduit, partly in tunnel, and 26½ miles of 38-in. steel pipe, connecting with the Rush storage reservoir on the way, and ending at the Mt. Hope distributing reservoir.

The submerged timber crib is shown by Fig. 3 on the inset. Water is drawn from a point about 26 ft. below the surface of the lake. The crib and the last section of the intake pipe were lowered to place together on Oct. 6, 1894, the main work of laying the intake having been started on Aug. 14, and dredging for the pipe channel having been begun on June 25.

The pipe for the intake was furnished by the Carroll-Porter Boiler & Tank Co., of Pittsburg, and was laid by Chambers & Casey, of Rochester. It was shipped from the shop in 30-ft. sections, and three sections and a ball and socket joint were riveted together on the shore, making about 100-ft. lengths for laying, ranging from 14 to 18 tons each. The first eight sections from the shore were ⅜ in. thick, and were strengthened with eight stiffening rings of 3 × 3½ × ½-in. steel angles, riveted to the center of each outside sub-section, the pipe being made up of lengths of 6 ft., c. to c. of rivets, five of which were joined together to make one of the 30-ft. shipping lengths. The eight remaining sections were 5-16-in. thick.

The flexible joints are shown by Fig. 9 in the text. They were made by the Central Bridge & Engineering Co., of Peterboro, Ont., which company also made the 70 and 48-in. flexible joints used at Toronto, and described in Engineering News of June 29, 1893. The Rochester joints differ from those at Toronto in having longitudinal and one circular stiffening rib. The flexible joints used at Syracuse were similar to those employed at Toronto, as was pointed out in our issue just referred to.

The intake pipe was laid on the bottom of the lake, which is of clay at this point, because bad material made a tunnel to the intake crib impracticable. A short length of pipe was first laid, projecting 25 or 30 ft. from the gate house on the shore. The first full length of pipe was laid inside a cofferdam. The balance of the intake was towed out on scows, connected up and lowered from pile platforms by means of winches.

The scows were built for this work, and were 16 × 24 ft., by 46½ ins. deep. Two scows were used for each section of pipe, placed with their greatest length at right angles to the pipe, thus giving 32 ft. of support to the pipe, with 12 ft. between and about 24 ft. unsupported at each end. The scows were made of 3-in. plank, except the deck, which was of 2-in. stuff, and were practically in the form of a large box of the dimensions given, with two longitudinal partitions.

At each flexible joint two clusters of six piles each, about 14 ft. apart in the clear, were driven on each side of the line of the pipe, capped at 10½ ft. above water, thoroughly braced and provided with a platform.

Each section of pipe was moved down to the scows on trucks running on a track of 3-ft. gage and lifted to the scows by steam-hoisting machinery. The scows were hauled out by hand by means of ropes, the distance being small and there being but 15 sections to place. The hauling was aided in some cases by power from the pile-driver engine. About 20 men moved the scow when Section 14 was placed, which the writer witnessed, and there were in addition two boats with two men each. The pipe was brought to place quickly; the free end of the last length laid was raised above the water by means of the winch and the joint made. Before lowering the pipe a timber platform, floated out from the shore, was strapped beneath the bottom of the joint to prevent the latter from sinking into the soft-clay bottom when lowered. After the connections were made both scows were removed by raising the pipe by means of the winches on the pile platform at each end, and the jointed end was lowered to its final resting place. The winch here was then free to be moved, on a scow provided with a trestle platform, to the location of the further end of the next section. The winches used on this work, four in number, were made by the Graves Elevator Co., of Rochester, after designs of the engineers of the Rochester water-works.

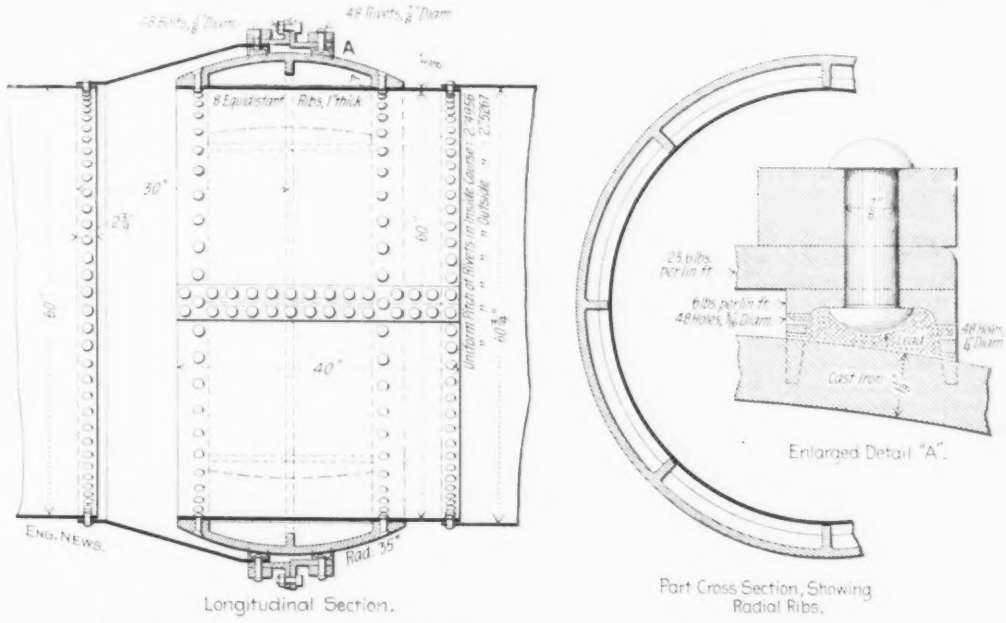

FIG. 9. FLEXIBLE JOINT FOR 60-IN. STEEL INTAKE AT HEMLOCK LAKE.

The masonry gate house, at the head of the conduit, is thus described by Mr. Kuichling:

> The gate house is arranged with two sets of passages to the conduit, both to secure ample area of screen surface, and to allow one set of sluice valves to be repaired without interrupting the water supply to the conduit. For the latter purpose, the openings through the partition walls are provided with strong iron guides for stop planks or shutters, so that any compartment may be isolated. A subterranean chamber was also formed at the mouth of the conduit, in which a weir can be placed for accurately measuring the supply taken to the city; and by removing this weir, room is afforded for launching a boat, either for making an examination of the tunnel at any time, or for attaching a sweeper. It may be mentioned, in this connection, that while the conduit is 6 ft. high and wide inside, the maximum depth of water therein will not exceed 4 ft., unless it be desired to waste it at the overflow chamber.

The contract for the gate house, the brick conduit, and the overflow chamber between the latter and the steel conduit, was let to Wm. Jones & Sons, of Rochester. Where the invert of the masonry conduit was more than 30 ft. below the ground surface, the conduit was built in tunnel, there being about 7,350 ft. of this work, and about 4,550 ft. of brick conduit in excavation. The six tunnel shafts are shown on the profile, Fig. 2. Most of the tunnel was in hard slate rock, which disintegrated on exposure to the air. Fig. 4 shows the method of constructing the tunnel in clay. Some of the most interesting of the tunnel-driving work is described by Mr. Kuichling as follows:

> The power for operating the rock drills was compressed air, which was transmitted through a long line of 4-in. wrought iron pipe, from a centrally located station to each of the shafts, and afterwards also to the north portal. Work was first commenced on March 2, 1893, at Shaft No. 3, and soon afterward at the other five.
>
> The tunnel work was prosecuted continuously throughout the 24 hours of each day, except Sundays, at a maximum rate of 8.33 ft., and an average rate of 5.71 ft., per day, at each of the twelve headings. On Aug. 8, the headings met between Shafts No. 2 and No. 3, and within a few weeks the other headings met, so that on Sept. 1, 1893, a continuous passage was formed between Shafts No. 1 and No. 6, a distance of 5,875 ft. Work at the two ends or portals was begun on Aug. 15 and 24, respectively, timbered shafts 30 ft. deep to grade being sunk at these points. From the south portal, the excavation was in clay southerly to the gate house, also northerly for 210 ft., after which it passed into and through soft, shale rock for a length of 130 ft., to hard and dense rock; from the north portal southerly, a similar soft rock was encountered for 224 ft., also for 50 ft. northerly, when the excavation passed wholly into clay. The work in this soft rock and clay was somewhat dangerous, and both the roof and sides of the tunnel here required heavy timbering and sheathing. In the firm rock, on the other hand, the roof needed no support, and but little trouble from the falling of material was experienced. Progress from the portals was, therefore, somewhat slower than from the shafts, the average rate being about 5 ft. per day; yet, on Oct. 16, 1893, the excavation of the entire distance of 7,350 ft. between the portals was completed.
>
> A 6-in. ventilating hole was drilled at some convenient point between each pair of shafts, as it was anticipated from the preliminary borings that some natural gas might be encountered. Most of these holes have been retained for use hereafter, and the tops of the iron casing pipes are now provided with hoods, as at the shafts. Three relatively short manholes were furthermore built over the conduit in open excavation, so that, in addition to the ends, access to the work can be gained at nine different points along the route.
>
> The tunnel masonry was completed on July 6, 1894, but before it could be used for conveying water to the pipe conduit, the interior of the whole work had to be scraped, washed and thoroughly cleaned, as considerable quantities of waste mortar, sand, mud and soot had gradually accumulated therein. After having been carefully cleansed, the surface of the brick work was given a thick coating of neat Portland cement, which was applied as a wash with large brushes.

The masonry of the conduit in tunnel and trench varied with the material encountered. In the clay trenches the inverts were of 6 ins. of concrete and 4 ins. of brick; the side walls and arch were of 8 ins. of brick, flanked with 12 ins. of concrete at the sides, the concrete being carried up 17 ins. above the spring line and sloped off to meet the arch, the balance of which was covered with mortar. All the brick was laid in Portland cement mortar and the concrete was of natural cement.

A good idea of the tunnel lining and the shaft manholes is contained in the following abbreviation of Mr. Kuichling's account of this work:

> Where the rock was hard and sound, the side walls

and arch were 8 ins. in thickness; and, as in the case of the conduit in open excavation, the entire space between the exterior of the brickwork and the rock sides was filled with concrete to near the top of the arch, above which the space was filled with fragments of stone from the excavation, all tightly packed or rammed into place. On removing the debris and exposing the sound rock on the bottom of the tunnel its surface was found to be very irregular, owing to the action of the explosives. It was therefore determined to make this bottom smooth and uniform in grade throughout by filling up all depressions with concrete, the lower portions of this filling, up to 4 ins. below grade, being made with natural cement mortar, while the top layer was made with Portland cement mortar.

In soft rock excavation, the bottom of the tunnel was lined with 4 ins. of brick; but in earth excavation two courses, in addition to the concrete, were used to form the floor. In other respects the construction was similar to that already described, except in places where the rock roof was very thin and loose. At these localities, the side walls and arch were formed of 12 ins. of brick; and at the shafts, where great strength was required, the brick lining masonry was made 16 ins. thick. The aggregate length of the 12-in. brick lining is 434 ft., and that of the 16-in. lining, 132 ft.

In each shaft, a brick manhole was built after the tunnel masonry had been finished, which was provided with a vertical iron ladder, resting platforms about 25 ft. apart, and a strong iron coping at the surface of the ground. The resting platforms were designed to be capable of being folded back against the brick work, so as to afford an unobstructed passage for large buckets from top to bottom, in case of future repairs or cleaning operations in the tunnel; and the top casting was furnished with a tight-fitting, locked cover, and a 6-in. ventilating pipe, terminating in a suitable hood.

At the junction of the brick and steel sections of the conduit, an overflow chamber is provided, as is shown by Fig. 5, on the inset. Fig. 6 on the inset and Fig. 10 in the text show another overflow

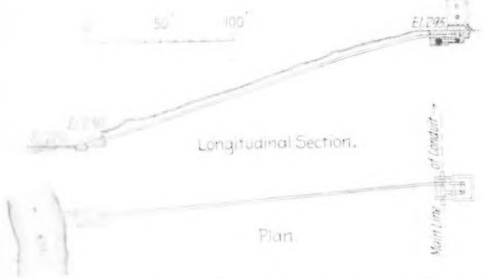

Fig. 10. Sketch of Overflow Tower and Pipe at Factory Hollow.

chamber, at Factory Hollow, which is thus described by Mr. Kuichling:

A comparatively novel feature of the pipe conduit is the provision of a device, midway in the long stretch of 17.5 miles from its commencement to Rush reservoir, whereby the pressures in the upper half will, under ordinary conditions of operating the works, always be limited to those due to the hydraulic gradient; while the maximum pressures in the lower half, which will result if the inlet valve to said reservoir be closed, will be about 26 lbs. per sq. in. less than those due to the entire available head. The device consists simply of a short stand-pipe, rising from the conduit on the top of a hill up to the hydraulic grade line for Rush reservoir, and communicating with an adjacent pipe, which is continued down the hillside to the creek. With the flow properly regulated by the gates at the lake, and free discharge into said reservoir, the water will not rise in the stand-pipe quite up to the level of the overflow, and hence no waste will ensue; but if the discharge at Rush is stopped in some emergency, the overflow will at once come into action and carry the entire flow safely into the creek, thereby preventing the head on the upper half of the line from acting on the lower half. The resulting loss of water from the lake will be trifling, as word can soon be sent to the latter place to stop the supply. On the other hand, the benefit derived from the device is the ability to use thinner plates for the pipe over a long distance, and thereby materially diminish the cost of the work.

The contract for the steel pipe line, ready for use, was first awarded to Moffett, Hodgkins & Clarke, of New York city, for $903,324, as nearly as could be estimated, the one bid for laying the main with cast iron pipe amounting to $1,173,110, or about 30% more, this latter bid having been put in by a combination of manufacturers. The above firm afterwards claimed that it had made an error in its estimates, and could not do the work at the price bid. Finally, the contract was awarded, on Jan. 20, 1893, to the next lowest bidder, Whitmore, Rauber & Vicinus, a Rochester firm, at prices estimated to amount to $1,123,920, which was about $50,000 less than the price for a cast iron pipe line. Steps by the city for the forfeiture of the bond of $90,000, submitted by Moffett, Hodgkins & Clarke, would have followed naturally, but the matter was taken into the courts and up to Jan. 27, 1895, had not come to trial. The bids for cast-iron pipe were on the basis of a diameter of 36 ins., it being estimated that cast iron pipe of this size would be equivalent in discharge capacity to a 38-in. riveted steel conduit.

The contract for making the steel pipe was sublet equally to the East Jersey Pipe Works, of Paterson, N. J., where the pipe for the Newark conduit was made, and to the Rochester Bridge & Iron Works. The steel plates used at Paterson were made by the Carnegie Steel Co., at Homestead, Pa., and those used at the Rochester shops, by the Paxton Rolling Mill, at Harrisburg.

The specifications called for soft, open-hearth steel, containing not over 0.6% of manganese and 0.06% of phosphorus, and having a tensile strength of between 55,000 and 65,000 lbs., an elastic limit of not less than 30,000 lbs., and an elongation of 22½% in 8 ins. Cold bending, punching and similar tests were also called for, but their character are not stated in Mr. Kuichling's paper. All plates less than 95% of the required thickness at any point were rejected without appeal.

The following facts in relation to the pipe line and the coatings used are condensed from Mr. Kuichling's paper:

It was contemplated that the pipe conduit should be a continuous riveted tube throughout its whole length, without expansion joints or other mechanical devices for compensating changes in length caused by variations in temperature. By this continuity, such changes are prevented from manifesting themselves, and are replaced by internal stresses in the metal, which are far within its elastic limit for the range of temperature encountered in the work; but it becomes essential in this case that the strength of the net section of the plate at the circular seams shall be equal to the shearing resistance of the rivets therein. The joints were therefore carefully designed to meet this condition, and at the ends of the conduit, motion was prevented by bedding the pipe in large masses of masonry. Similar precautions were also observed in the design of all stop-valves and branches which were inserted in the pipe line. All of these appurtenances were provided with flanges and bodies of considerably greater strength than the pipe, and were connected thereto by numerous heavy bolts.

Great care was taken to make accurate maps and profiles of the route on a large scale. Upon these the pipe was carefully drawn, and every deviation from a straight line clearly indicated, after which they were handed to the manufacturer. It was required that the pipe should be made so as to bring all the straight seams in the upper quarter of the circumference.

Half the lengths of pipe were made larger in diameter than the other half by twice the thickness of the pipe. Thus the smaller lengths just slipped inside the larger lengths, and the conduit is made up by joining the two alternately. The internal diameter of every inside course was made exactly 38 ins. throughout, and the net length of each course between the centers of the rivet holes at the ends ranged from 6.83 to 6.75 ft., according to the thickness of the plates. Each course or section was made of a single sheet, of such width as to form the required cylinder with ample allowance for overlap.

Four classes of pipe, formed of three different thicknesses of plate, were manufactured and arranged according to the pressure to which they would be subjected in the line of the conduit. For pressures due to static heads of 120 ft. or less the pipe was made of plates ¼ in. thick, with the longitudinal or straight seams single riveted; for heads ranging from 120 to 153 ft., the same thickness was used, but the straight seams were double riveted; for heads between 153 ft. and 199 ft., the thickness was 5-16 in., and for heads between 199 and 263 ft., the thickness was ⅜ in., with the straight seams double riveted in both classes.

All of the circular seams were single riveted, except where two different classes of pipe were joined together, in which case these seams in the thinner pipe, including the junction seam, were double riveted for a distance of about 200 ft. The object of this provision was to make the efficiency of the double-riveted round seams in the thinner pipe approximately equal to that of the single-riveted round seams in the thicker pipe, as it was computed that, in the distance mentioned, the friction of the earth against the pipe after the trench is properly refilled, would be sufficient to balance the resultant of the longitudinal forces produced in the two classes of pipe by the assumed extreme variation of temperature in the finished conduit, which was here taken at 45° F. Each class of pipe is therefore regarded as being firmly anchored in the soil, except for the said distance at the junctions.

The pipe was generally furnished in lengths of about 27½ ft., consisting of four courses riveted together in the shop, and having all seams thoroughly calked on both the inside and the outside. Changes of direction, either in alinement or grade, were made by slightly beveling, at one end only, as many courses as were needed to make the required curve or deflection. To avoid multiplicity of patterns, a standard bevel of 2° 43.5′ corresponding to an offset of 1.806 ins. in the dieter of 38 ins., was adopted and used as far as possible throughout the work. With this deflection it was still practicable to make a good circular seam without "flanging" or hamering over the ends of the courses. If a somewhat smaller angle was needed occasionally, a special pattern therefor was made; and deflections of less than ⅛° were easily accomplished by slightly reaming out the rivet holes on opposite sides in the round seams.

The above-mentioned standard bevel on the end of every fourth course forms a regular polygon which fits closely a 10° curve; applied on the end of every second course, it corresponds to a 20° 8′ curve, and on the end of every course, it gives a 41° 9.75′ curve. These three curves may also be defined in terms of their radii, which are 573.7, 286.1 and 142.2 ft., respectively; and all changes in direction and grade of the pipe conduit were made in accordance therewith. The work was in general so arranged as to avoid making a change of grade in a curve, although in a few instances such a combination could not be obviated without incurring large additional expense for excavation.

As soon as practicable after the riveting and calking on a pipe was finished, it was thoroughly cleaned, heated in an oven to about 300° F., and then placed in a large tank containing the hot coating mixture, where it was allowed to remain for such time as would suffice for the temperature of the metal to become the same as that of the mixture. The pipe was then removed from the bath and the surplus coating substance allowed to drip off, after which its treatment by the two different manufacturers varied materially. At the East Jersey Pipe Works, a purely asphaltic coating was used which became hard when cold; and hence, after having been dipped, the pipes were simply placed on skids outside, where the material was left to harden. At the Rochester Bridge & Iron Works, on the other hand, a species of japan coating was used, which required the pipe to be placed vertically in a large brick oven after dipping, and baked therein at a high temperature for about 10 hours, on an average.

Much attention was given to the matter of preparing and applying a coating mixture which should be durable, hard, tough and adhesive to the smooth surface of the steel plates at all ordinary temperatures. Numerous experiments with different kinds of asphalt and other substances had been made by the writer, at intervals during several years before the new conduit was projected, in the hope of finding a compound which would meet all of these requirements; but, as they were generally more or less unsatisfactory in fulfilling the last-named condition, it was deemed expedient, after the decision to use steel pipe in the new work was reached, to seek counsel from some chemist who had made the preparation of paints, varnishes and lacquers a special study. In response to various inquiries, the writer was referred to Prof. A. H. Sabin, of the well-known firm of Edward Smith & Co., varnish manufacturers, of New York, and finally succeeded in persuading him to undertake the necessary investigations. Much time, however, was required for this purpose; and as the East Jersey Pipe Works were soon ready to commence making pipe the proprietors were directed to use meanwhile the same asphalt coating which had been found to be very successful on numerous conduits in California, as well as on the large steel conduit recently completed for the water supply of Newark, N. J. This material had been highly commended by several distinguished chemists, and it was generally regarded as superior to any other preparation of asphalt which had yet been devised.

Every effort was made to obtain materials of the best quality for the purpose from California, also to prepare and apply the coating in the most approved manner. The results at first appeared to be very gratifying, but after the pipes had been exposed to the air for several weeks it was noticed that the high gloss of this coating gradually disappeared, thus leading to the inference that the substance was undergoing a slow change. In water, on the other hand, no alteration was detected, and it was therefore believed that the coating would prove serviceable after the pipes were once filled. It also failed in adhering tightly to the metal, and the contractors were subjected to great expense in painting with costly material large areas from which the coating had scaled off during transportation and handling. Directions were then given to substitute for the California asphalt a mixture of refined Trinidad asphalt, and the best grade of coal tar, thereby producing the same coating as had been applied to the old conduit, and which has proved to be durable at all events. Although this mixture was, on the whole, more satisfactory than the other one, it nevertheless left much to be desired in the way of toughness and adhesion to the steel.

Meanwhile the experiments of Prof. Sabin, in the direction of obtaining a better practicable coating, had resulted in the evolution of a japaning process which,

from both theoretical and practical considerations, gave promise of conspicuous success, and its use for the remainder of the conduit was decided upon. At this time, however, the East Jersey Pipe Works had nearly completed their portion of the work, while the Rochester Bridge & Iron Works was just commencing operations on the pipe. The proprietor of the latter was accordingly requested to investigate the Sabin process thoroughly, and to adopt it if no valid objections could be raised against it by the expert chemists he was to employ for the purpose. As no such objections were forthcoming, and nothing better was available, he promptly constructed the necessary expensive plant for carrying out the process under Prof. Sabin's direction, and coated all of his pipe in this manner. So far as can now be determined, this coating is superior in all respects to those which were applied to the first half of the conduit, and it is hoped that the crucial test of time will fully confirm this opinion.

Great care was also required in the handling and transportation of the pipes, both by railway and by wagon, to avoid damaging the coating. To this end, all chains and bolsters or saddles which came in contact with the pipe were covered with old rubber hose, canvas or carpeting, and the site where each pipe was deposited, preparatory to excavating the trench, was thoroughly cleared of stones. In spite of these precautions, the abrasion of the coating in spots was unavoidable, not only from the processes of transportation, but also from the subsequent processes of riveting the pipes together. It may also be mentioned that during the latter work, canvas coverings or mats were placed on the top of the pipe outside, and on the bottom inside, wherever the workmen were engaged; and all who entered the pipe for any reasons were required to use soft felt or rubber overshoes. As it was essential that every defective place in the coating should be repaired as well as possible, the use of a suitable asphaltic paint was necessary, and in the absence of anything better, a preparation called "P. & B. Paint" was selected for the purpose. This material consists of refined asphalt dissolved in bisulphide of carbon; and as the latter is a very volatile liquid, its rapid evaporation soon leaves a thick coating of hard asphalt on the metal.

The offensive odor of this liquid, however, is a serious objection to its use on the interior of the pipe, as the vapor is both suffocating and inflammable; hence it was necessary to insure the thorough ventilation of the conduit during its construction. For this purpose, as well as to afford future ingress for examination and repair, manholes with tightly-fitting covers were riveted upon the pipe at intervals of about 1,000 ft. The covers of two or three consecutive openings were removed while the interior of the conduit was being examined, and newly-driven rivets and abrasions in the coating were being painted, and a strong current of air was forced through these portions of the pipe by means of a suitable fan or blower. In this manner the performance of the necessary inside painting work and its thorough inspection was made durable.

After the pipes had been delivered along the route of the conduit, two lengths were riveted together upon the surface of the ground, thus forming a section about 54.5 ft. in length, and weighing from 7,000 to 10,500 pounds, according to the class. These sections were then rolled in succession by a large number of men upon suitable timbers placed across the trench, where one or two strong derricks raised them clear of the timbers and lowered them safely to the bottom of the excavation. One end of a section was then carefully fitted into the pipe which had previously been laid, and was temporarily fastened thereto with a number of bolts passed through the rivet holes. The exact adjustment of the section to its proper alinement and grade was then done, and after the rivet holes had all been made to coincide, either by reaming or a slight turning of the pipe, the joint was ready for the riveters.

Upon the completion of lengths of a mile or more of the conduit, each such section was in its turn thoroughly cleaned out and examined to see that all defects in the coating had been made good with paint, whereupon the ends were tightly closed up, either temporarily with a steel boiler head or permanently with a stop valve, and the pipe filled with water from a force pump. The water pressure was gradually raised until it became about 50% greater than that to which the conduit would afterward be subjected in its normal operation; and while under this pressure the work was closely examined for leakage. For the portion of the conduit from Rush to Mt. Hope reservoir, the force pump was not needed, as the static head was amply sufficient for testing purposes.

At every summit in the conduit line, an air-valve of peculiar construction has been placed (see Fig. 7, on the inset). The function of these appurtenances is both to afford a facility for letting out the air which may be confined in the pipe before it is filled with water, and to allow air in abundance to enter automatically, in case that water is drawn out from blowoffs or escapes from a rupture in the pipe. Three different sizes, affording clear openings of 3, 4 and 6 ins. in diameter, were used in the work. The devices consist, respectively, of one, two and four similar bronze valves, suspended from springs and attached to a suitable cast iron chamber, which is bolted to a horizontal stop valve, and the latter to a flanged casting riveted upon the pipe. The stop valve is left wide open, but if the air valve gets out of order, the former may be closed and the repair made without shutting off the conduit. As it is necessary to keep these fixtures free from frost, earth and mischief, they are inclosed in an iron case deeply covered with earth, and from which a capacious stand-pipe projects about 3 ft. above the surface of the ground. The top of this stand-pipe is covered with an iron hood, in which there is a small opening, also covered with a locked flap, to receive the key whereby one of the cluster of air-valves may be pressed down and opened. For the admission of air, the valves are all opened automatically by the pressure of the atmosphere as soon as the water pressure is removed, since the tension of the springs is only sufficient to balance the weight of the metal.

Corresponding to the air-valves, a blowoff for emptying the pipe, in case of cleaning or repair, was provided in every depression. One of these was made 8 ins. in diameter, and all the others were 6 ins. They consisted of two stop valves, bolted together, and to a flanged casting riveted on the lower quarter of the pipe, the valve nearest the latter being kept open and regarded as a reserve in case of injury to the other one, which is ordinarily kept closed. An iron pipe, leading to the natural watercourse or drainage ditch in the depression, serves to carry the overflow, when the valve is opened, to some distance from the conduit. At each blowoff, both the main pipe and the pair of stop valves are supported upon a bed of concrete, so as to reduce the danger of any breakage in the connection from unequal settlement.

Ten large and heavy 36-in. stop valves are placed in a line of the conduit from its beginning to Rush reservoir, and six such valves are set between Rush and Mt. Hope reservoirs. Of the former, five are placed in such positions that if a parallel conduit about 2.56 miles in length is ever required through that portion of the valley where the new conduit crosses nine times under Honeoye Creek, three connections between the two can be made so as to divide this somewhat hazardous part of the route into two sections, either of which can be cut out by means of these valves without greatly impairing the efficiency of either of the two lines. Provision has also been made for connecting with the old conduit at two points, the first at Richmond Mills, where the old pipe may be made to partially supply the new line, and the second near North Bloomfield, where the relative elevations first become such as to enable the new line to feed the old one. There is no immediate necessity for making any of these connections.

The old and new conduits are also connected indirectly in the new gate house at Rush reservoir (see Fig. 8, on the inset), where a complexity of valves is found necessary for the purpose of avoiding grave annoyances in the future, when another conduit from Hemlock Lake is built. The pipes and valves have here been arranged so as to allow any of the conduits coming to the reservoir to feed any of the pipes leaving it for Mt. Hope reservoir. A similar provision has also been made at the point in Pinnacle Ave., about 400 ft. north of Elmwood Ave., where the present new pipe deflects abruptly to Mt. Hope reservoir, the intention here being to treat the deflected line as a branch to the latter reservoir, while the conduit itself is continued to a new distributing basin, as previously mentioned.

Another large group of valves occurs in the new gate house at Mt. Hope reservoir, where the new conduit is directly connected with two new 36-in. distributing mains. These latter pipes are also designed to take water from the reservoir; but as it may become desirable at times to obtain a somewhat higher pressure in the city than is afforded from said reservoir, it has been planned to equip each of these pipes with a check-valve, which will close automatically when they are fed from Rush reservoir, and will reopen when the connecting valves are shut.

For the present, only temporary connections with the two reservoirs have been made by means of a short line of 16-in. pipe laid over the bank at each locality; but as the available pressure is large enough to deliver from 10,000,000 to 12,000,000 gallons per day through both lines, they are amply sufficient until next summer, when the permanent connections will be made. In the performance of this work, it will be necessary to empty both reservoirs and keep the water out for some time, in order to cut through the banks, lay the various large inlet and outlet pipes, construct the masonry screening wells, and finally refill the excavations; and as it was expedient to have full assurance from long continued good service, that the new conduit would not require shutting off for repairs during this period, the work was accordingly postponed.

Referring to the total cost of the entire work, Mr. Kuichling states that it will probably fully exhaust the original appropriation of $1,750,000. The gates used in this work were furnished by the Rensalaer Manufacturing Co., of Troy, N. Y. The chief assistants of Mr. Kuichling were Messrs. Edwin A. Fisher, Walter H. Sears, Gaylord Thompson, and LeGrand Brown.

Some of the notes taken by the representative of this journal, who visited this work last fall, have been embodied in what has preceded. Additional points of interest obtained during the visit are as follows:

The branch conduit to Rush reservoir is of 36-in. cast iron, about 1,000 ft. in length, and rising 40 ft., the reservoir being this much out of grade. A reservoir on a lower level may be built later on, but for the present, the capacity of the pipe will be sufficient, notwithstanding this loss of head.

The 36-in. stop-gates have 4-in. stems and are provided with set screws so that the discs can be held up while new stems are being put in.

Before dipping the pipe in Prof. Sabin's japan coating, each one was heated in a horizontal oven which would take in three pipes. All the handling was, of course, done by power. The dipping vat at Rochester was horizontal, with brick walls, lined with iron, making a semi-cylindrical vat 6 ft. in diameter and 32 ft. long. The heating furnace was below the vat, and crude oil was used as a fuel. The baking oven was of brick, about 9 × 25 ft. in the clear, and high enough to admit the 28-ft. sections on end. Twelve could be baked at one time.

The baking, Prof. Sabin informs us, was done at a temperature of 500 to 600° F., and he also states that he prepared the japan on the spot, but for future work, he will make it at the varnish works and ship it in barrels wherever needed.

THE WEBB & THOMPSON TRAIN STAFF SYSTEM: C., M. & St. P. Ry.*

The train staff system of operating trains on single-track railway lines has been used in England for nearly 40 years, and, with the practically identical train tablet system, is still the only method of block-working single track railways in that country. The first American railway to use this system was the Chicago, Milwaukee & St. Paul Ry., which, in May, 1894, began to operate a short stretch of its line lying between Savanna, Ill., and Sabula, Ia., three miles, by the Webb & Thompson electric train staff system. The Chesapeake & Ohio Ry. later adopted it for working traffic on one of the single-track sections of its line, where tunnels and other heavy works have prevented the extension of the double tracking. In a paper read at the March meeting of the Western Railway Club, Mr. C. A. Goodnow, Division Superintendent of the Chicago, Milwaukee & St. Paul Ry., described the experience of that road with this system, and we abstract the main features of this paper in the following paragraphs:

The lines of the southern district of the Chicago, Milwaukee & St. Paul Ry. cross the Mississippi River between Savanna, Ill., and Sabula, Ia. The distance between these stations is three miles, and there is one grade crossing, one drawbridge, and one local station in the block. Over this track, which is single, the traffic of about 3,000 miles of the company's lines passes. During a larger part of the year the traffic is heavy (the bridge block being the neck of the bottle, so to speak), and will rarely fall below 50 trains per day at any time.

The division yard is located at Savanna, on the east side of the Mississippi River, making it necessary for the trains of both divisions west of the river to use the bridge block, and, moving the traffic from so large a territory, it is to be expected that they will be irregular in number, and that they will bunch during certain hours. The use of a time table showing the

* The Webb & Thompson train staff system was described and illustrated in our issues of March 29, 1890, and Jan. 18, 1894; Wise's train staff system was described in our issue of June 23, 1888, and the Tyer train tablet system in our issue of Jan. 18, 1894, while in our issue of April 26, 1894, we described and illustrated systems for exchanging staff and tablets at block stations by trains running at high speed.

trains over the bridge block was abandoned, because it was found impossible to so arrange it as to make it a reasonably correct exhibit of the traffic. Nor was it possible to move trains through the despatchers of either division, as the work on their respective divisions would not permit the close attention to the bridge block which the nature of the service demanded. To meet the conditions described, a train order by card system was adopted, which was in successful use for many years. It was virtually a staff system, the card representing the staff, but it lacked one element: it was impossible to interlock the cards. As traffic increased, and the acceleration of trains became necessary, it was apparent that the company would be compelled to either double-track the bridge block or find some unobjectionable way of handling the trains. Owing to the character of the country the construction of a second track would have been very expensive, and the selection of a satisfactory system for handling the traffic became the subject of much thought and investigation. After a thorough examination and inquiry the Webb & Thompson electric traffic system was adopted.

Each staff station is furnished with a staff instrument (Fig. 1), and in each instrument there are ten or more staffs. In one instrument there is one permissive staff and six permissive tablets. Let X represent Savanna and Y Sabula. A train is at X for Y. In accordance with a code of telegraph and bell signals, X asks Y for permission to withdraw a staff. If Y considers it proper for the train to proceed, he sends an electric current to X and unlocks the instrument there. This enables X to withdraw a staff, which is handed to the conductor of the waiting train and by him to the engineer, who places it in a bracket on the side of the cab and in full view. On arrival of the train at Y the staff is handed to the conductor and by him to the operator, who places it in his staff instrument. Until this is done it is not possible for a second staff to be withdrawn from the instrument either at X or Y.

These results are obtained by mechanical arrangement, as follows: In Fig. 2 the letter a indicates an electro-magnet provided with four coils, and when X has asked permission to withdraw a staff, as described above, he turns the indicator F, which sends an electric current through two of the coils. When Y gives

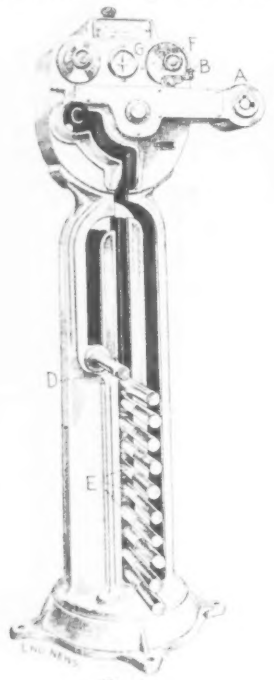

Fig. 1.

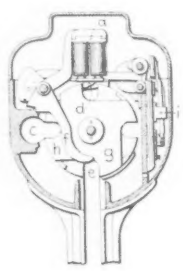

Fig. 2

Fig. 3.

Fig. 1. Perspective View of Webb & Thompson Staff Instrument. Fig. 2. Interior Mechanism of Train Staff Instrument. Fig. 3. Perspective View of Staffs and Tablet.

permission he does so by pressing the key B, which sends an electric current through the remaining two coils. These currents being of proper polarity, the magnet becomes energized and firmly grips the armature on lock d. This fact is indicated to the operator at X by the deflection of the galvanometer needle G, and he proceeds to lift one of the staffs to the top of the slot e. When at the top of the slot, a projection on the staff strikes and lifts the tail-piece f, electric currents, before described, cause it to grip the armature or lock d, the lock is lifted with it so that the drum g is relased and free to turn as the operator draws the staff through the segmental slot h to the opening C, where it is withdrawn from the instrument.

The turning of the drum g by the withdrawal of the staff at C reverses the direction of the current from Y through the spring connections i, so that the current now passes through the two coils of the instrument at X in a reverse direction to the current passing through the other two coils, and as one current neutralizes the other there is no power to energize the magnet, and the armature or lock d is therefore

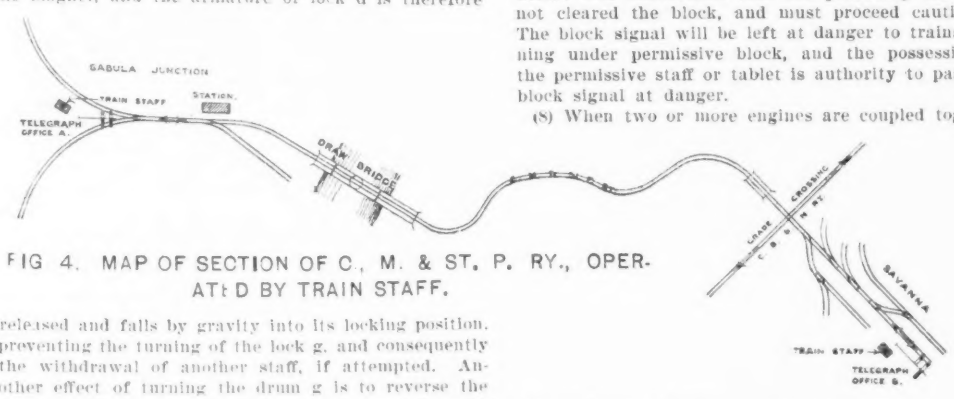

FIG 4. MAP OF SECTION OF C., M. & ST. P. RY., OPERATED BY TRAIN STAFF.

released and falls by gravity into its locking position, preventing the turning of the lock g, and consequently the withdrawal of another staff, if attempted. Another effect of turning the drum g is to reverse the direction of the current, which can be sent from X to Y, so that this current no longer has any effect on the magnet at Y. In order to bring the currents in unison, the staff withdrawn must either be replaced in the instrument at X or taken to Y, and placed in the instrument there. Assuming the latter to be done, the effect is to turn the drum G in the instrument at Y one-quarter round, which changes the polarity of the current sent from Y to X, and that sent from X to Y, and brings the two currents again into accord. Permission may now be given to withdraw a staff from either instrument.

When it is desired to send a train forward permissively the permissive staff D is withdrawn from the instrument in the same manner as in the case of the other staffs, and used to unlock a box containing six permissive tablets, A. Each train to be sent forward permissively is to be given a tablet (Fig. 3), the last train taking the staff and the remaining tablets, if any. Until all the tablets have been locked in the tablet box of one instrument or the other, it is impossible to place the permissive staff in either instrument.

This is effected in the following manner: The removal of one tablet from the box A drops a dog or catch at C. The permissive staff has a large ring, K, which cannot be passed beyond the dog. The staff cannot therefore be placed in the instrument so long as one or more tablets are absent from the tablet box. As long, therefore, as the permissive staff is out of the instrument, no other staff can be withdrawn. The permissive staff has a key on one end, L, which unlocks the tablet box. When unlocked the staff cannot be removed from the box.

If there are switches in the block they are locked with a staff lock, and can only be opened with a staff. Unless the switch is set for the main track and locked in that position the staff cannot be withdrawn from the switch lock. If trainmen leave the switch wrong, they must do so by leaving the staff in the lock. Failure to deliver the staff means that no other staff can be taken from the instrument. An engineer, therefore, knows when he has a staff in his possession that no switch can be wrong.

The following rules, abstracted from the list of "Instructions to Conductors and Engineers," given in full in the paper, will give a pretty clear idea of the method of running trains through the block:

(1) No train or engine shall be run in either direction between Savanna and Sabula Junction unless the engineer has in his possession a train staff or permissive tablet, which must be handed him by the conductor of his train and retained by him as long as his train or any portion of it is in the block. The possession of a staff or tablet is authority for the engineer to proceed regardless of opposing trains, provided the block signal is in proper position and the conductor's signal has been given.

(2) The conductor of a train or engine is the only person authorized to receive a train staff or tablet from the operator in charge, and must personally hand the same to the engineer. On arrival at the opposite end of the block the conductor must obtain the staff from the engineer, and if all his train is within the station limits, personally deliver to the operator.

(3) In case a train parts or it is necessary to double, the train staff or tablet must be retained by the engineer until all the train is clear of the block.

(4) Before accepting a permissive tablet from the operator conductors must know that the operator has the permissive staff in his possession.

(5) Under no circumstances will a staff or tablet be transferred from one train to another. They must invariably be delivered to the operator strictly in accordance with these instructions.

(6) Engineers who receive a regular staff will understand that all trains are clear of the block. They must be careful to note whether they have a regular or permissive staff. There is but one permissive staff. It differs in shape from the regular staff; is painted green, and is marked "Permissive staff."

(7) Engineers who receive the permissive staff or tablet will understand that the preceding train has not cleared the block, and must proceed cautiously. The block signal will be left at danger to trains running under permissive block, and the possession of the permissive staff or tablet is authority to pass the block signal at danger.

(8) When two or more engines are coupled together the engineer of the last engine, or the engine attached to the train, must carry the train staff or tablet, but the engineer of the other engine must know that he has the staff or tablet before proceeding.

The rules governing the operators of the staff machines relate largely to the manipulation of the machines and the code of electric signals to be used between them. The paper continues:

With this system, from the brief description preceding, it is clear that the bridge despatcher has no responsibility, except to give the proper trains the preference. He may delay traffic, but he cannot create a condition of danger. It is not necessary for him to provide for a proposed or supposed movement of trains by sending numerous orders, only to find it necessary to cancel them, because the train cannot move as expected. He is in touch with the yardmaster at Savanna, and with the despatcher of both divisions, and through these sources is fully informed in regard to the probable movement of trains in both directions. He may have expected to hold a freight train for a passenger train, which is reported on time at some distant station, only to find that the passenger train has lost time, and that he can just squeeze the freight train into the terminus. There is no necessity for sending hurried orders with attendant possibility of error. He simply signals for a staff, and in five seconds or less the engineer has his authority to go forward. Or suppose the situation reversed. A passenger train reported late has made up so much time that another train which is approaching, and for which a staff has been withdrawn, cannot go forward. Transportation men know the delay which results when it is necessary to change or make telegraph orders void. No such delays occur with the staff system. It is only necessary to leave the signal at danger; replace the staff in the instrument (enabling one to be withdrawn at the other end of the block), and the passenger train goes forward, with no loss of time. In case of so great a delay to a train, to which a staff has been delivered, that it is desirable to recall its permission to move, the staff is brought back to the office and replaced in the instrument, thereby cancelling its authority to proceed in a manner which cannot be misunderstood.

A METHOD FOR DETERMINING THE SUPPLY FROM A GIVEN WATERSHED.

By James L. Greenleaf, C. E.

A water-supply project which involves the use of a watershed of limited area invariably presents to the engineer the fundamental question, "What supply is available from this district?"

He may be looking for a watershed that will supply a given town, or, as has occurred in the vicinity of New York city, the search may be for a city or town to use a given watershed. Whatever the case may be, there is the problem which, in one form or another, is bound to rise before him.

The elements of the problem to be solved are the run-off with its coefficients of periodic variation from the yearly average, and the consumption governed by its similar set of coefficients. Unfortunately the coefficients of, let us say, monthly variation from the mean are not the same for run-off and for consumption. Therefore great expense is usually incurred in supplying reservoirs, in which the surplus run-off over the consumption during high-flow months can be stored to make good the deficiency during low-flow months. It is at once apparent that, with the run-off and consumption varying by different ratios from month

to month, and with the available reservoir sites usually prescribing a limit to the amount of storage room possible, it becomes a nice matter of adjustment to ascertain how large a population a given watershed will supply when worked to its full capacity under the limitations of storage existing on that watershed.

The suggestions I have to offer for a process of solving this problem concern not so much the nature of the data as the method of handling them. They are applicable to whatever data suit one's individual opinion.

No issue is raised with those who claim that only actual gagings of the stream are of value; in fact, I turn eagerly to gagings whenever obtainable. It is not my purpose to champion the use of percentages of rainfall for calculating the run-off, although I fail to see what other data one has to start with in many water-supply projects.

The particular diagrams presented are based upon ratios of consumption obtained from the Providence records, and upon the use of 80% of the average rainfall, and the ratios of monthly run-off to mean monthly rainfall computed from 19 years of gagings of the Croton, as given in the report of the Aqueduct Commission.

One is at liberty to place his own value upon the use of such data. These ratios of run-off, by the way, bear a decided similarity to the ratios of the Boston water-supply, and to a set computed from gagings of the Pequannock, kindly furnished by Clemens Herschel, M. Am. Soc. C. E., the Engineer of the East Jersey Water Co. The systematic gaging of this stream, so admirably carried on under Mr. Herschel's supervision, is making its records of yearly increasing value.

Finally, as a conclusion to this preface, it should rapid summing up of rectangles along the edge of any convenient strip of paper will indicate the amount of storage on hand at any time of the year. A glance at the rectangles for any month —June, for example—will show how far the run-off goes towards making up the consumption for that month and the demand upon the reservoir.

It is evident that the surplus of the high-flow months must, at least equal the deficiency of the low-flow months, or, in other words, the required storage. The lines C along the upper ends of the consumption rectangles form, therefore, a mean line graphically equating the surplus and deficiency for the year. The sum of the shaded rectangles above the line C must, at least, equal the sum of the shaded rectangles below.*

The question will arise, How is the consumption line determined, and the answer requires the preliminary statement that there are three ways in which this water-supply problem may present itself. One may want to determine the maximum possible consumption that a given watershed will supply, and the necessary storage capacity for that purpose; or the consumption required by a given town may be a stated quantity, and the problem be to compare a given watershed with it; or, finally, one may have a given watershed and one or more available reservoir sites of ascertained capacity, and the problem then is to determine what is the allowable maximum consumption under the limitations of storage imposed. The available reservoir sites exert a controlling influence upon the gram is presupposed, and this makes only a few words of comment necessary. The two divisions of the watershed are combined, and the consumption line, C, is obtained in a way precisely similar to that described for diagram No. 1. Then a summation is made, to see if the surplus of the high-flow months is equal to or greater than the deficiency of the low-flow months.

I have recently had occasion to apply diagram No. 2 to a New England watershed, with satisfactory results, and can recommend it with confidence as a brain and time-saving device. There is the further advantage that from it one can study the relations month by month of the run-offs from each of the two watersheds to the consumption, and the rates of filling or exhaust from each reservoir, as also the effect of drawing from the upper to replenish the lower reservoir.

In December, for example, the consumption takes all the run-off of the main watershed, and nearly all that from the secondary watershed, leaving a narrow rectangle, C D, of surplus to remain in the secondary reservoir. In May the run-offs from both watersheds are taken, and also the rectange, D C, is drawn from one or the other of the reservoirs, as may be desired. As a matter of fact, in the illustration given the surplus of the high-flow months is considerably less than the deficiency of the low-flow months. This is caused by basing the consumption upon the full storage capacity available. Hence a portion of the available storage must be excluded from the calculations, and

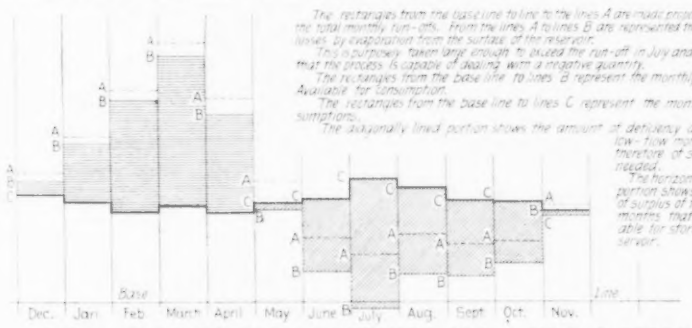

FIG. 1. CASE OF ONE WATERSHED AND A SINGLE RESERVOIR.

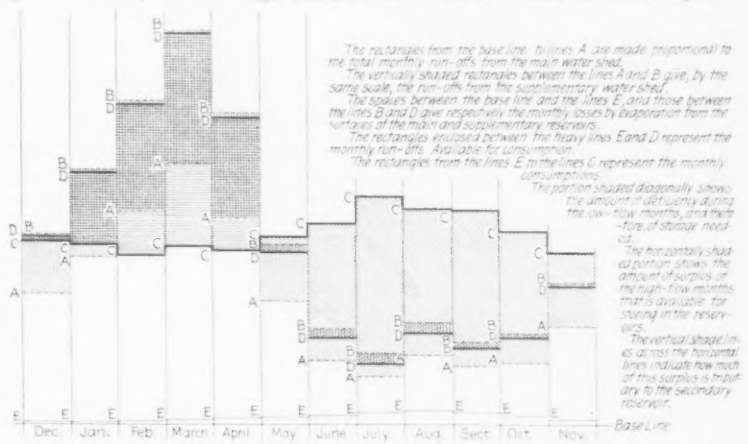

FIG. 2. CASE OF MAIN WATERSHED AND ITS RESERVOIR, AND A SECONDARY WATERSHED WITH TRIBUTARY RESERVOIR.

be stated that elaborate calculations are wellnigh futile, for very small watersheds. Refinements of computation are liable to be entirely upset by the variations of different years.

An inspection of the diagrams shows that they are simply examples of graphical arithmetic. The usual method of adjusting the consumption to the run-off and storage available is to tabulate in a series of columns the run-off, evaporation from water surface, consumption, etc., and strike a balance. I think that a brief examination of the diagrams justifies the assertion that the same result is accomplishel graphically, with a rapidity at least equal to that of the tabular method. Moreover, in cases where there are two or more divisions of the watershed, and several reservoirs, the diagram avoids the greater part of the effort that is necessary in order to draw a clear mental picture of the conditions out of a mere tubular statement.

This latter fact gives great advantage to the graphical process, if the engineer desires to place the conditions of a project clearly before the directors of a company, or before a board of water commissioners. A table may easily prove a meaningless mass of figures, while a diagram will picture before them, in all their relations, the conditions of flow and consumption, and the amount of storage at any period of the year. It may be suggested in passing that a judicious use of colors will add greatly to the effectiveness of the diagrams.

Diagram No. 1 applies to the simple case of a single watershed, with one reservoir only. A reading of the description accompanying the diagram will explain its nature, and such reading should precede the following comments upon it. The special feature of the diagram is that it shows at once the true relations of surplus and deficiency. A consumption line in this case, because they may give more or less storage than the surplus run-off of the high-flow months, whereas the total actual storage for the year cannot exceed this surplus run-off.

I will take the last of the three phases of the problem, and explain for it the obtaining of the consumption line, C.

Add together the available run-offs of the low-flow months, after allowing for evaporation from water surfaces; these, for ordinary proportions of reservoir capacity to watershed, and for the Northeastern states, will usually include from May to November. To their sum add the total available storage capacity, as ascertained from surveys, less 20%, if so desired, to allow for a year of exceptionally low rainfall. Divide by the number of low-flow months, and thus obtain a mean monthly consumption for the low-flow months. Lower this amount slightly (in the case of the Providence ratios the lowering is 3%), and obtain the yearly mean of monthly consumption. Lay off the rectangles for monthly consumption, using the proper ratios, and thus construct line C. Then, if the surplus of the high-flow months equals or exceeds in amount the sum of the deficiencies of the low-flow months, the problem is solved; if not, the consumption line must be lowered until this condition is satisfied.

Diagram No. 2 applies to a case frequently met with, where there is a division into a main watershed, with its reservoir site, and a secondary watershed, with its reservoir site tributary to the lower reservoir. In this case, as for the first diagram, a reading of the description accompanying the diagram is presupposed, and this makes only a few words of comment necessary. The two divisions of the watershed are combined, and the consumption line, C, is obtained in a way precisely similar to that described for diagram No. 1. Then a summation is made, to see if the surplus of the high-flow months is equal to or greater than the deficiency of the low-flow months.

I have recently had occasion to apply diagram No. 2 to a New England watershed, with satisfactory results, and can recommend it with confidence as a brain and time-saving device. There is the further advantage that from it one can study the relations month by month of the run-offs from each of the two watersheds to the consumption, and the rates of filling or exhaust from each reservoir, as also the effect of drawing from the upper to replenish the lower reservoir.

In December, for example, the consumption takes all the run-off of the main watershed, and nearly all that from the secondary watershed, leaving a narrow rectangle, C D, of surplus to remain in the secondary reservoir. In May the run-offs from both watersheds are taken, and also the rectange, D C, is drawn from one or the other of the reservoirs, as may be desired. As a matter of fact, in the illustration given the surplus of the high-flow months is considerably less than the deficiency of the low-flow months. This is caused by basing the consumption upon the full storage capacity available. Hence a portion of the available storage must be excluded from the calculations, and the consumption line correspondingly lowered. A trial will show to what extent this is necessary.

The case of three or more divisions of the watershed, each with or without a reservoir, requires a modification of the process already illustrated. A separate diagram of monthly run-offs should be made for each of the divisions of the watershed, and a piece of colored paper of the size of the rectangle placed upon every rectangle, using a distinctive color for each division of the watershed. Then the diagram for the lowest division of the watershed should be taken to build upon, and on it a trial consumption line drawn, the position of which can be approximately estimated in advance. It remains to build up to this line for each month, when the run-off of the lowest division is below it, by cutting off sections of colored paper from the corresponding rectangles of one or more of the other divisions of the watershed, and pasting them in place. The balance of the rectangle in each division remains to help in filling its storage reservoir. In this way a diagram is constructed which will show by its different colors the entire story by months of the different divisions of the watershed, and of the drafts upon their several reservoirs throughout the year.

The East Jersey Water Co.'s system, on the Pequannock, with its threefold division into the Oakdale, the Clinton and the Macopin watersheds—the first two each having a reservoir—furnishes an admirable example for this method of treatment. It would be given here as an illustration, were it not for the difficulty of printing in colors, and the draft that has already been made upon the space of the Engineering News. It is evident that the case of diagram No. 2 can be treated by this method, if desired.

* It is a pleasure as well as a duty to record my indebtedness for the fundamental idea of this mean consumption line to my late chief, Gen. W. P. Trowbridge. The profession owes much to his memory, and his personal friends far more.

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Several communications have recently been received, intended, apparently, for our department of "Letters to the Editor," but with only a nom de plume signature. All letters to the Editor must be signed with the writer's real name in order to receive attention, though in publication a nom de plume signature will be used if the writer prefers.

Since our last issue the official announcement of the board of engineers appointed to inspect and report upon the proposed Nicaragua Canal, changes the list of men first given. Major Wm. Ludlow, Corps of Engineers, U. S. A., represents the Army, instead of Colonel Craighill, as at first stated; Civil Engineer M. T. Endicott remains as the representative of the Navy, and the civilian engineer is Mr. Alfred Noble, M. Am. Soc. C. E. While Major Ludlow is somewhat lower in rank than Col. Craighill, he is an officer with an excellent reputation as an engineer, and has had long experience. He has been for some time past Military Attache at the Court of St. James. Judging from his controversy a few years ago with the Lighthouse Board, he is a man with very decided opinions of his own and may not conduct the affairs of this board quite as smoothly as Colonel Craighill would have done. Mr. Noble is an engineer of broad experience, especially in connection with deep and difficult foundations and river work. He was the executive Engineer in the building of the Washington bridge, across the Harlem in New York, and the Engineer in direct charge of the construction of the Cairo bridge across the Ohio River, and of the great bridge crossing the Mississippi at Memphis. He has the reputation of being an indefatigable worker, exceedingly careful in all he undertakes, and his opinions and recommendations will carry corresponding weight. Taken altogether, the commission is a good one, and their report will be awaited with interest.

The difficulty of getting men to express their professional opinions and experiences as freely in a more or less formal discussion as in a casual conversation is one that is met with more or less by every technical society, and the American Society of Civil Engineers at present is having a hard struggle with it. This unfortunate fact was especially evident at the meeting on April 3, when it was proposed to have a joint discussion upon a paper presented in abstract by Mr. H. H. Campbell, on "Specifications for Structural Steel," and upon the final report of the commitee on "Uniform Methods of Testing Materials Used in Metallic Structures, and on Requirements for these Materials to Further Improve the Grade of Such Structures." This report was presented at the annual meeting in January, as noted in our issue of Jan. 17, and in view of the somewhat lively discussion then started it was voted that opportunity should be given for discussion at a regular meeting. If there is any one subject upon which an exceptionally interesting discussion might be expected from an assembly of engineers and steel manufacturers, it is that of specifications for and tests of steel; yet, as a matter of fact, there was no general discussion, a few communications being read and some desultory remarks made in regard to Mr. Campbell's paper, and the committee report was but briefly mentioned, which is certainly very much to be regretted. The attendance was large and representative, and it is hardly necessary to say that the failure of the discussion was not due to any lack of members able to present facts and experience of general interest.

Just what the cause is for this lack of freedom in the discussions before the Society it is difficult to say; perhaps it is as much mere custom as anything. Some men able to talk intelligently upon the subject may be deterred from speaking through a fear that they will be considered to be pushing themselves forward if they take part in the discussion without special invitation. If once the custom becomes fixed in a society to have members take part in a discussion only on call of the chair, it is always a matter of great difficulty to re-establish free and unrestrained discussion in the meetings.

The value of brisk discussions, in giving interest to technical meetings, however, is so great that in some way or other it must be secured if the attendance of the members whose attendance is most desired is to be secured. Men interested in particular subjects attend the Society meetings, not so much to hear a paper read which they can more conveniently study at home, or at the office, as to hear other men express their opinions in informal debate.

How the discussions before the Society can be enlivened and made worthy of the Society's high reputation, is a matter which should receive the earnest attention of the officers. If no better plan suggests itself, it would be well to try the scheme of sending special invitations to take part in each discussion to a half-dozen or more men, in advance of each meeting, selecting, of course, those whose opinions on the special subject in hand will be best worth having on record in the Society's "Transactions."

There is one feature of English railway practice that we would gladly see introduced into this country, and that is the annual stockholders' meeting. Of course, annual meetings of the stockholders of railway companies are held in this country, but they bear no resemblance to the English institution, being merely the formal announcement by the holders of the controlling interest that they have a majority of the outstanding stock, or the proxies therefor. The English railway meeting is no such perfunctory affair. It is an assemblage of those who actually hold the shares as an investment, and they criticise the management and its acts with a most refreshing freedom and vigor. These meetings, moreover, are not held behind closed doors. The press representatives are there, and both the daily newspapers and the financial journals publish detailed accounts of the proceedings. Such public ventilation of a corporation's affairs has a most salutary effect as a sanitary measure. The two great Canadian railway companies follow English practice quite closely in the conduct of their financial affairs, but while the Grand Trunk's annual meetings are held in London, the Canadian Pacific meetings are held in Montreal, and furnish about the only example on this continent of an annual meeting of railway stockholders conducted as it should be.

The report of the recent C. P. R. meeting, published in full in the Montreal "Gazette," is very interesting reading. It shows, in the first place, that among the largest stockholders in the company, with the amount of the holdings of each, are the following: Sir Donald A. Smith, 10,000; Sir Wm. C. Van Horne, 1,500; Sandford Fleming, M. Am. Soc. C. E., 3,000; John W. Mackay, 500; Lord Mount-Stephen, 4,750. Of course, the company has had to take its portion of hard times with other railways during the past two years. Net earnings, which were $8,420,000 in '92, dropped to $7,741,000 in '93 and $6,423,000 in '94, and this, with the almost total stoppage of sales of the company's lands, made it necessary to cease dividend payments. The company's stock, which sold in 1892 at 90, is now quoted at 40, and when such a drop in the price of securities occurs, the charge is pretty sure to be made that those in charge of the company's financial affairs have taken advantage of their knowledge to dispose of their own holdings of stock, thus depressing the price and "bearing" the market. Concerning this charge President Van Horne said in his address:

> Reference has recently been made in some of the financial journals abroad to what is called "inside selling" of the company's shares, presumably selling by directors or others prominently connected with the company, and in a position to be familiar with its affairs. The list of shareholders now on the table will show that the trifling changes in the holdings do not warrant any such statement. I may take occasion to say in this connection that while in the history of the company some of the directors have incurred heavy risks, and made perhaps unwarranted sacrifices in its interest, it can safely be affirmed that no one of them has been individually benefited to the extent of one penny through any of its works or operations.

Of even more interest in this connection is the statement of the venerable Sir Donald Smith, which we quote in full as follows:

> I believe I am by far and away the largest individual shareholder in this company. It has been said, and has been referred to by the president, that there has been "inside selling," that is, selling with a knowledge of the position of the company. I can say positively, however, that this is not the case, and I will say further, as regards myself, that I hold now what I did in 1892, and that had I desired to sell out, I might have made the difference between the price of the stock at this moment and what it was then, at least $500,000 or $600,000. I don't say that to you, gentlemen, with a view of pointing out what I have done as a shareholder, but I do it to show that I have so much confidence in the company and in the future of the C. P. R. and Canada that I feel even now my stock is safe. With regard to those who take the position of directors in one company or another, I look upon it not only as improper, but as most immoral, that a shareholder should become a director, and consequently trustee for a body of shareholders, and should benefit in any way by the knowledge he has gained as a director. I can say that has not been the case with the directors of the C. P. R.

Whether it is possible to establish such a standard of morality in the financial management of railway properties in the United States as that which Sir Donald Smith lays down, remains to be seen; but the signs are very clear that unless and until it is done the investing public is likely to turn a deaf ear to the sellers of railway securities.

In the last volume of the Proceedings of the Society for Promoting Engineering Education, there is a short paper by Prof. J. B. Johnson that suggests a most useful addition to the usual course of an engineering student. That is the teaching of engineering specifications and the law of contracts. As Prof. Johnson well says, the drawing of important specifications and the writing of contracts are wisely left to engineers of experience and discretion; but this is no reason why the student should not be made familiar with the general principles involved and the many pitfalls to be avoided in connection with documents of this class. In fact, the student's advance to the condition of necessary experience will be all the more rapid by reason of this early training. The time involved in such a course would be brief, for it would simply mean the pointing-out of the easiest paths which the student should follow to gain the greater knowledge for himself. For this intimate knowledge he must depend upon the careful study of existing standard specifications for various classes of work, but the student needs, and should have, some guidance here in teaching him broadly what is good and what is bad practice, and to enable him to select good models. As to the law of contracts, it is not supposed that the engineer can substitute himself for the lawyer by any knowledge he might thus gain, and he would probably "have a fool for a client" if he attempted it. But, as Prof. Johnson says, some knowledge of law is very useful to the engineer in keeping him out of trouble in his ordinary practice, and in this would lie the value of even a little training in this direction

FIG. 1. MAP SHOWING LOCATION OF NEW AND OLD CONDUITS.

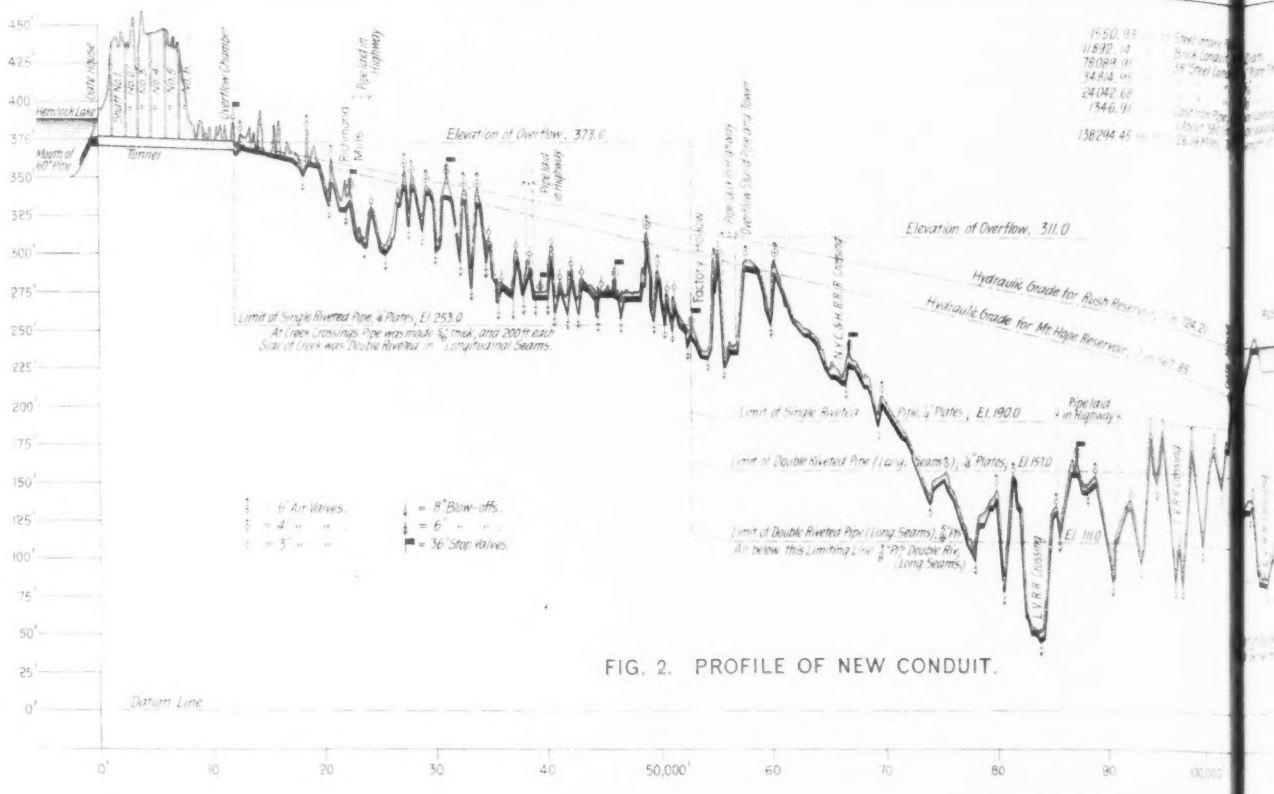

Hemlock Lake
Mouth of 60" Pipe
Tunnel
Overflow Chamber
Pipe laid in Highway
Elevation of Overflow, 373.0
Elevation of Overflow, 311.0
Factory Hollow
Hydraulic Grade for Rush Reservoir
Hydraulic Grade for Mt. Hope Reservoir
Limit of Single Riveted Pipe, 4 Plates, El. 253.0
At Creek Crossings Pipe was made 5/8" thick, and 200 ft. each Side of Creek was Double Riveted in Longitudinal Seams.
Limit of Single Riveted Pipe, 4 Plates, El. 190.0
Limit of Double Riveted Pipe (Long. Seams), 4 Plates, El. 151.0
Limit of Double Riveted Pipe (Long. Seams), 5/8 Plates, El. 111.0
All below this Limiting Line 3/8" Double Riv. (Long Seams)
= 8" Blow-offs.
= 6" " "
= 36" Stop Valves.
Datum Line
0'
10
20
30
40
50,000'
60
70
80
90
100,000

FIG. 2. PROFILE OF NEW CONDUIT.

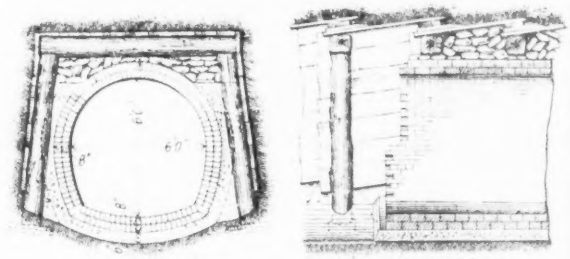
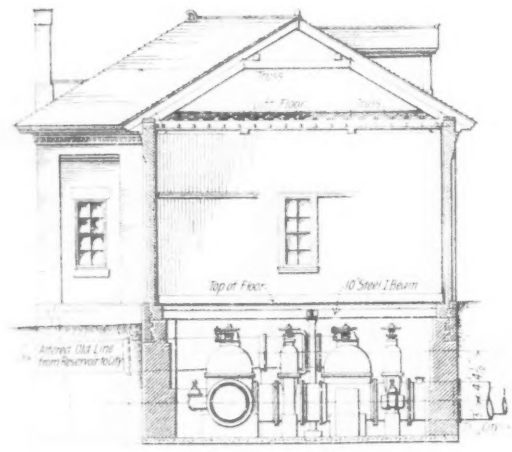


FIG. 4. BRICK CONDUIT IN TUNNEL THROUGH SOFT CLA



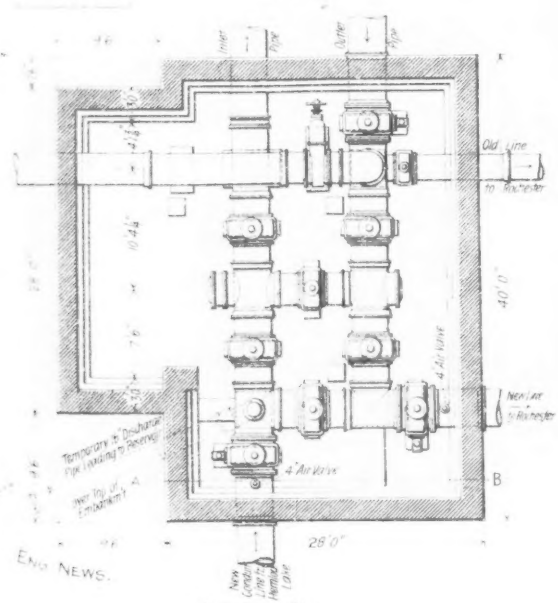
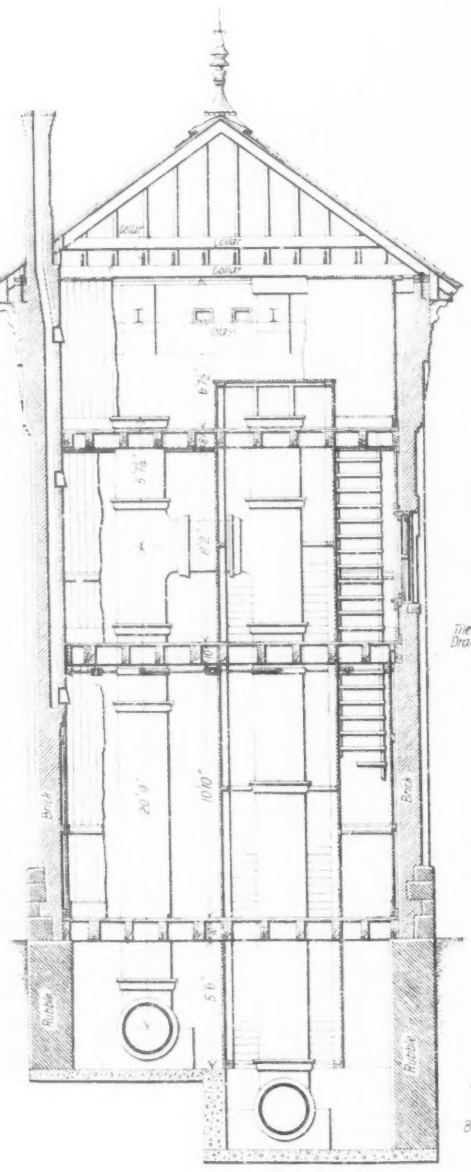


FIG. 8. GATE HOUSE AT RUSH RESERVOIR.



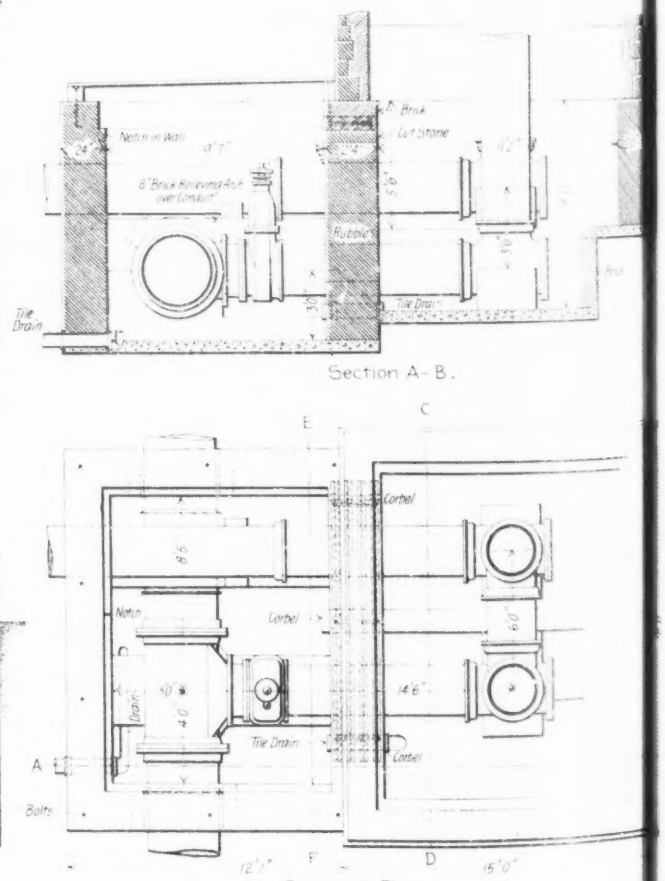
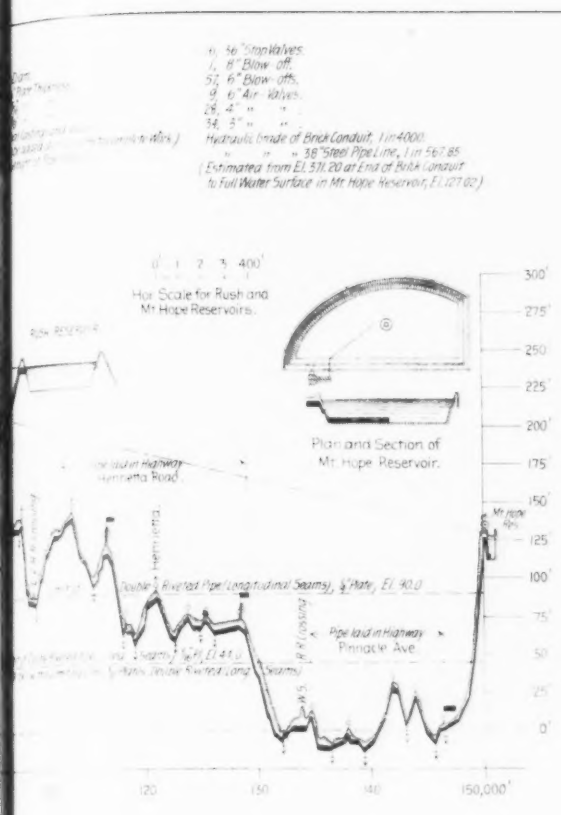
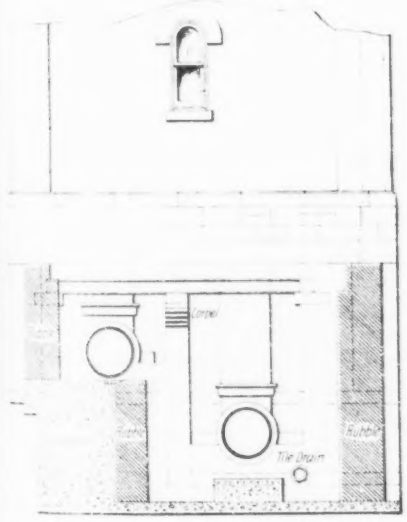


FIG. 6. OVERFLOW PIPE CHAMBER AT FACTORY HOLLOW

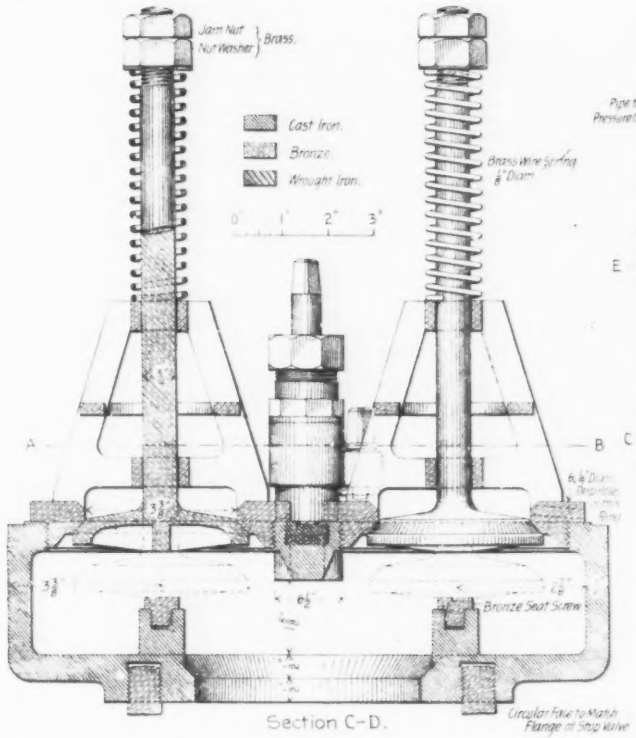
THE NEW HEMLOCK LAKE WATER SU

Emil Kuichling, M. Am. Soc. C

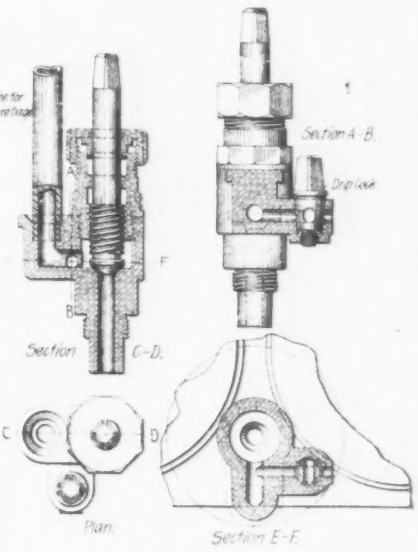




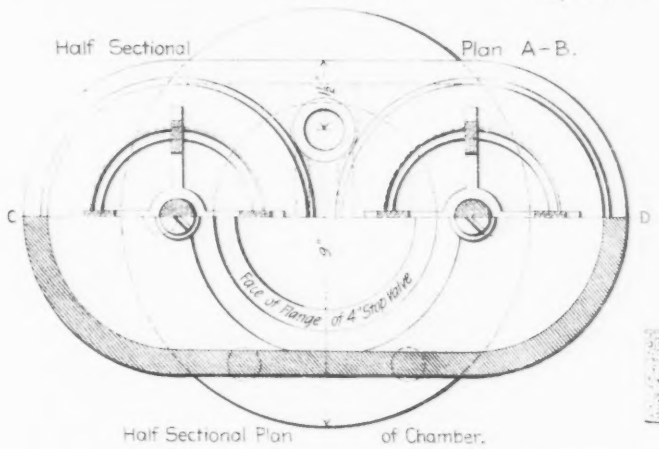
Section E-F.



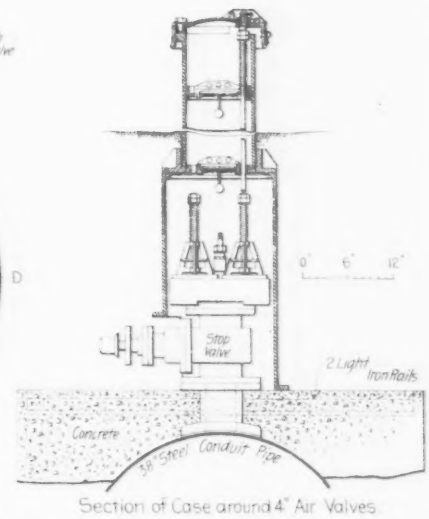
Section C-D.



Details of Main Valve.

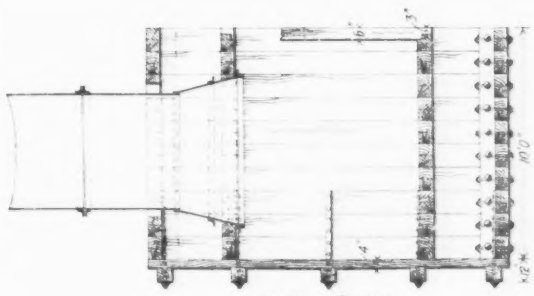


Half Sectional Plan of Chamber.

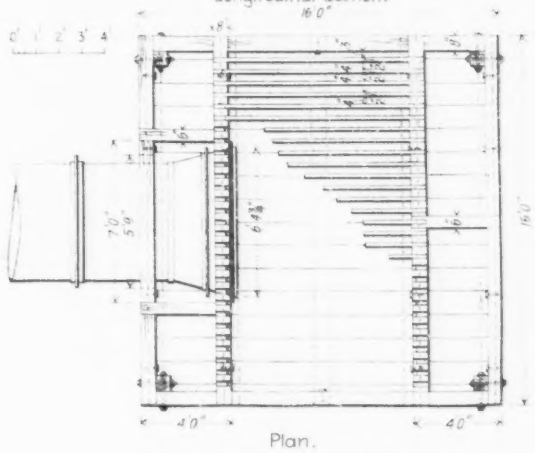


Section of Case around 4" Air Valves.

FIG. 7. DETAILS OF 4-IN. AIR VALVES.

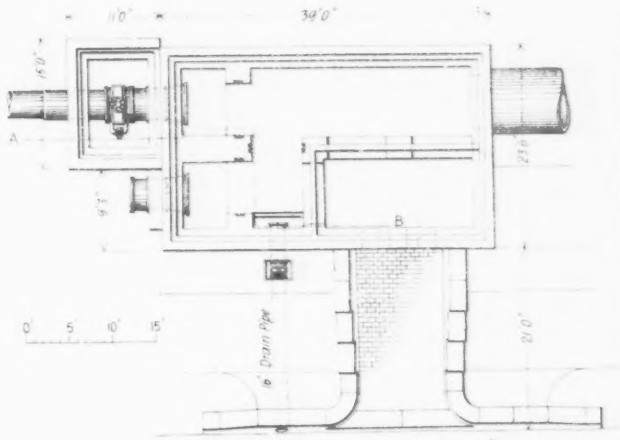


Longitudinal Section.



Plan.

FIG. 3. SUBMERGED INTAKE CRIB.



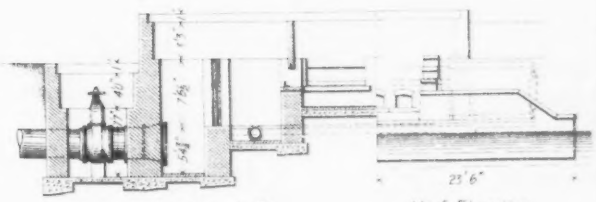


FIG. 5 OVERFLOW CHAMBER BETWEEN BRICK AND STEEL SECTIONS OF CONDUIT.

ER SUPPLY CONDUIT FOR ROCHESTER, N.Y.

. Am. Soc. C. E., Chief Engineer.

CHAS. HART & SONS, LITH., 16 VESEY ST., N. Y.

Another useful pointer for teachers and engineering students is to be found in the same volume, in a paper presented by Prof. J. J. Flather, of Purdue University. After treating of mechanical drawing in technical schools, Prof. Flather touches upon the great importance to the engineer of a thorough training in freehand sketching, and the value of this training throughout his professional life. With a very little experience the young student will soon recognize the fact that his eye is untrustworthy until trained, and that to improve upon these conditions he must carefully cultivate his powers of observation. To see accurately and quickly, to recognize the true proportions and relations of objects or parts of a machine are first requisites in an engineer in almost any branch of practice. Freehand sketching is of wonderful assistance in the cultivation of these faculties, and in point of real importance and practical value ranks with the best training in mechanical drawing. In fact, a bold, well-proportioned freehand sketch, with the proper general dimensions added, will often convey to a workman a better idea of what he is called upon to make than would the carefully-made, fine-lined drawing, which the average engineering student deems so essential and sufficient for this purpose. The majority of successful engineers can "talk with their pencils" quickly and well, and every engineering student should learn to do so. He will find it useful in explaining his plans to his superiors and to his subordinates,and the constant cultivation of this faculty will result in quickening those powers of observation so invaluable to the successful engineer. The essential thing is to learn to see accurately, and to truthfully convey to paper what he sees; style and artistic effect are non-essentials in this class of drawing, though practice will eventually impart a style and effect of their own to the sketch, simply because it boldly and freely conveys the true appearance and proportions of the object. With Prof. Flather, we believe that much profit will result to the young engineer who is early taught the true importance of freehand sketching.

THE JURISDICTION OF THE SECRETARY OF WAR OVER NAVIGABLE WATERS.

A ruling in respect to the obstruction of navigable streams by engineering structures has recently been made by Attorney-General Olney, which, should it be upheld by the Federal Courts, will have an important and far-reaching effect upon the future practice of engineers having to do with such work.

Briefly stated, Attorney-General Olney's ruling is that any person desiring to bridge a navigable river, or to erect therein a dam, boom or other structure which may be accounted an obstruction to navigation, should apply for permission to the Secretary of War instead of going to the trouble of getting a special bill passed by Congress granting the desired permission. Further than this, the ruling holds that "navigable" waters of the United States are not merely those on which sail or steamboats are or may be used, but include all streams and tributaries on which timber, rafts and even saw-logs may be floated. Thus, every stream capable in any sense of carrying interstate commence is under the jurisdiction of the Secretary of War. If it be located wholly within a single state, the consent of the legislature or other authorized body of that state should first be secured, after which the approval of the Secretary of War should be sought. All waters, however, which lie on the boundaries between two states are within the sole jurisdiction of the Secretary of War.

The statute under the authority of which this ruling was made was Section 7 of an Act approved Sept. 19, 1890, as amended by Section 3 of the River and Harbor Act, approved July 13, 1892, and reads as follows:

> Sec. 7. That it shall not be lawful to build any wharf, pier, dolphin, boom, dam, weir, breakwater, bulkhead, jetty, or structure of any kind outside established harbor lines, or in any navigable waters of the United States where no harbor lines are or may be established, without the permission of the Secretary of War, in any port, roadstead, haven, harbor, navigable river, or other waters of the United States, in such manner as shall obstruct or impair navigation, commerce, or anchorage of said waters; and it shall not be lawful hereafter to commence the construction of any bridge, bridge draw, bridge piers and abutments, causeway, or other works over or in any port, road, roadstead, haven, harbor, navigable river, or navigable waters of the United States, under any act of the legislative assembly of any state, until the location and plan of such bridge or other works have been submitted to and approved by the Secretary of War, or to excavate or fill, or in any manner to alter or modify the course, location, condition or capacity of any port, roadstead, haven, harbor, harbor of refuge, or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless approved and authorized by the Secretary of War:
>
> Provided, That this section shall not apply to any bridge, bridge draw, bridge piers and abutments, the construction of which has been heretofore duly authorized by law, or be so construed as to authorize the construction of any bridge, drawbridge, bridge piers and abutments, or other works under an act of the legislature of any state, over or in any stream, port, roadstead, haven or harbor, or other navigable water not wholly within the limits of such state.

It must be freely conceded that the full meaning and purport of this enactment are not plain at first sight. The Attorney-General in his ruling remarks that "it is infelicitously, not to say clumsily, drawn." But there it stands on the statute book as one of the laws of the land, and its interpretation by the Attorney-General will stand as its lawful meaning unless the Courts decide differently.

The way in which this ruling came to be made, according to our information, was as follows:

The Altamonte Water Co., as has been noted in past issues of this journal, is a corporation formed to develop a great water-power by storing the waters of the St. Louis River and conducting them to Duluth, Minn., with the purpose of furnishing to that city and to the neighboring city of Superior, a water supply and also a supply of cheap power by electric transmission. The president of the Altamonte Water Co. is Mr. E. S. Jenison, 1520 Monadnock Block, Chicago, Ill. A little more than a year ago the company made application to the War Department for permission to dam the St. Louis and Cloquet rivers in Minnesota. Up to this time the War Department appears to have been totally ignorant of the extensive powers conferred upon it by the Act above quoted, and the promoters of bridge schemes, etc., seem to have been in equal ignorance, and to have followed the old plan of pushing bills before Congress without regard to the effect of the new law.

The Department, therefore, upon being informed by the Altamonte Water Co. as to the statute upon which it based its application for a permit, applied to the Attorney-General for a ruling as to whether it had jurisdiction to grant or refuse such a permit. In his reply, on Feb. 9, 1894, the Attorney-General said:

> Upon the facts as stated in your letter, both the St. Louis and Cloquet rivers must be deemed navigable waters of the United States. Being such, they can be obstructed by dams only by permission of the Secretary of War, to whom Congress by express statute has given exclusive jurisdiction of the subject.

On June 12, the War Department again appealed to the Attorney-General, asking for a more detailed interpretation of the statute above referred to, and explicitly pointing out that if the ruling already made were correct, Congress had placed an enormous task in the hands of the War Department. In his reply to this, on June 25 ,a long opinion on the statute in question was returned by the Attorney-General, wherein the law was interpreted in the manner above explained.

The importance of this ruling to every one interested in bridge construction, or in work of any other sort which involves the obstruction of navigable waters is manifest; and for this reason we have taken considerable pains to investigate the circumstances leading to this decision of the Attorney-General and to ascertain its force and scope in other cases and under other conditions. It will, of course, be understood that the final interpretation of this statute lies with the United States Courts, and already one opinion bearing upon it has been handed down. This was in the case of the United States vs. Burns et al. (54 Fed. Rep., p. 351), in which Circuit Court Judge Goff said:

> In the 7th section of the act under consideration Congress has authorized the building of many structures that may obstruct or impair the navigable waters of the United States, provided the permission of the Secretary of War has been first obtained. By that section it is made unlawful to hereafter build in the navigable waters of the United States any structure of any kind in such manner as will obstruct or impair navigation without the permission of the Secretary of War. The evident intention of Congress was to take exclusive charge of such matters in the future for the United States, and to place them under the charge of the Secretary of War, leaving it to his discretion to authorize or prohibit the building of the structure and the creation of the impairment of navigation, thus rendering it unnecessary to apply to Congress for permission or special legislation in particular cases, as had frequently be done theretofore. At the time of the passage of this act authority to build structures of the character mentioned in it had been given by the states, as well as the United States, and Congress did not intend to prevent their construction absolutely, but prohibited those only authorized by the legislative assembly of the states until the location and plan of the structure had been submitted to and approved by the Secretary of War.

This decision of Judge Goff appears to be even more positive in placing the exclusive control over navigable waters in the hands of the Secretary of War than is the ruling of the Attorney-General.

We have given these rulings, etc., quite fully in order that our readers might have the arguments, made in support of these rulings for study. For, while the ground on which these rulings are based appears to be pretty substantial, on the other hand, there has been an astonishing ignorance of the provisions of this bill on the part of all parties concerned. The most amusing feature of the case is that Congress itself appears to have been in ignorance of the fact that it had clothed the War Department with power to attend to the whole matter of bridge and dam permits. So individuals and corporations went on spending time and money to get bills for their structures through Congress, and Congress calmly went on wasting time in considering and discussing these bills, with total disregard of its past action in placing the responsibility of granting or denying the privileges entirely with the Secretary of War. Numerous bills authorizing the construction of bridges over navigable streams have been introduced into Congress and become laws since the approval of this statute in July, 1892. It seems wellnigh incredible that the counsel employed by the great railway companies and other corporations who have gone before Congress with these bills should be entirely ignorant of the intentions of Congress in passing the statute, or of the possible scope of the statute when passed.

That Congress was actually ignorant of the passage of such a law is shown by a rather amusing incident. In December last a bill came before Congress in which the fact that the Altamonte Water Co. had obtained permission of the Secretary of War to construct dams across the St. Louis and Colquet River was set forth. The House of Representatives, therefore, passed a resolution calling upon the Secretary of War for information as to what laws he had acted under in granting such a permission. In reply the entire correspondence between the War Department and the Department of Justice was transmitted and was printed as Ex. Doc. No. 137 of the 53d Congress, Third Session.

But this ignorance of existing statutes by Congress and by promoters, of course, does not affect the status of the law. The only question is as to the correct interpretation of the undeniably obscure section which covers the matter. What the existing interpretation is we have already stated. Whether the higher Federal Courts will take a different view is a matter concerning which it would be unsafe to prophesy. We may say, however, in view of the fact that the intent of the legislators has much to do with the interpretation of statute law, that according to our information, the proceedings before the committees which had this bill in charge have been investigated, and have shown that it was the actual intent of the framers of the law to relieve Congress of the burden of the bridge business and to clothe the Secretary of War with all necessary powers to enable him to handle it.

So much for the law as it stands. A few words may be said, in closing, as to whether the change which it makes is one to be commended, in the public interests. On this question it is difficult to see but one side. To require a separate Act of Congress to enable the construction of each bridge across any navigable waters of the United States is merely a relic of the days when the nation was so small and its enterprises so few that the examination of an application for letters patent on a new invention was conducted by a joint board, consisting of the Secretary of State, the Secretary of War and the Attorney-General.

The real investigation as to the merits or demerits

of bridge schemes has long been done by the Secretary of War, and his competent staff, the officers of the Corps of Engineers. So far as Congress has acted upon these questions, it has been merely to add another bit of red tape and formality, or else to make use of them for log-rolling purposes. Moreover, the office of Secretary of War is not an elective office, as is that of the Congressman, and he has little temptation to curry favor with the people of any particular locality by granting some pet measure affecting that locality. His agents, the Engineer Corps of the Army, are even more independent of the ballot, and can act according to their best judgment without fear of sectional prejudice or local politics. How great a power these influences are in the action of the average Congressman is known to every person who has had to work against them in pushing bills through Congress.

It may perhaps be said that a power involving such great commercial interests should not be given absolutely into the hands of any one man, however free from political influence he may be. Let us see what reason there is in this view. If Congress could investigate and study each case of a proposed bridge or dam coming before it, so that each member could become thoroughly conversant with all the conditions, it is quite reasonable to believe that in the long run all interests would be better conserved than if the judgment of any single person decided on their advisability. Theoretically, the supposition is that this careful study is given to such bills; but practically every one knows that it is not given, and cannot possibly be given. In the often-quoted words of our Chief Executive, "we are confronted by a condition, not a theory," when we consider the matter. No member of Congress can inform himself carefully regarding each bill which comes before him for action; consequently he looks for information from some one who is already familiar with the conditions, in nine cases out of ten to the Congressman from the district affected by the bill, and acts on this information. He may be in many cases perfectly safe in doing so, but he is not acting according to the high ideal of personal knowledge and conviction which he is theoretically supposed to do, and in other cases he may be knowingly or unknowingly simply a tool for working out some personal or political scheme of his advisers.

The Secretary of War, as we have said above, escapes much of this danger by the independent nature of his office. That he will make a despotic or corrupt use of his power is hardly to be feared, even were he disposed to do so. The strength of public opinion, the fear of the courts, and, withal the knowledge that his ruling can be overthrown by his successor in office, will prove pretty thorough safeguards in these respects.

LETTERS TO THE EDITOR.

REVERSION LEVELS.

Sir: As the reversion level and its introduction is now occupying attention, please allow me space to say that I had a level of that class placed on a transit made to my order by W. & L. E. Gurley, Troy, N. Y., in October, 1883. Very respectfully,

E. A. D. Parker.

7, 14th St., Sioux City, Ia., March 25, 1895.

AN EASY WAY TO REDUCE SQUARE FEET TO ACRES.

Sir: Recently, in referring to the article on "Land Surveying" in "Trautwine's Pocketbook," I noticed that he divides by 43,560 to reduce square feet to acres, instead of multiplying by the reciprocal .000023 — more exactly, .00002295684—a much shorter operation. Few men seem to use the reciprocal, and it may benefit some members of the profession to call their attention to its advantage. Yours truly,

R. A. MacGregor.

Baltimore, Md., April 5, 1895.

RAILWAY WORK IN CUBA.

Sir: In a short time there will be opened for traffic the new branch of the Sabanilla & Marota Ry., the grading, iron bridges and trestles being finished, and tracklaying is fast nearing completion. There is a spur line to the rich manganese ore deposits of the Ponnpo Mining Co. (a corporation of Bethlehem, Pa.). The main branch is projected to Gauntanamo, about 37.2 miles further than the present end of construction at La Maya, but this will probably not be undertaken at present, on account of local disturbances in the government of Cuba, and the difficulty of securing material of construction owing to the duties to be paid on imports, which did not exist under the reciprocity treaty. This part of the island is very poorly provided with railway communications, and there are splendid opportunities for railway investors. The Phoenix Bridge Co. has just finished a contract with the Sabanilla & Marota Ry. for supplying and erecting four bridges, the contract amounting to $40,000. Two of the bridges replaced wooden bridges on the old line of the road, and the other two are for points on the branch line now being completed. The new branch starts near the Cristo station, at a point 11.12 miles from Santiago de Cuba, and runs to Samaya, 10 miles, from where there is a spur of 1.86 miles to the Ponnpo manganese mines. Mr. John F. Anderson, of Anderson & Barr, Jersey City, N. J., is President, and Mr. Chas. Ziegenfuss, of Santiago, Cuba, is Superintendent. Yours respectfully, Geo. W. Pfeiffer,

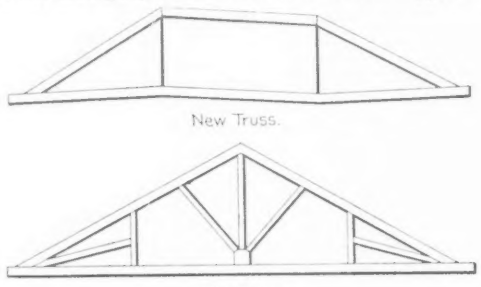
Ch. Engr. Sabanilla & Marota Ry.

Santiago de Cuba, March 15, 1895.

A ROOF TRUSS WITHOUT COUNTER-BRACING.

Sir: During the last few days I have been overseeing the wiring of our county court house for incandescent lighting, and in so doing I have had occasion to visit the garret of both the old and new parts. I enclose you a sketch of the roof truss, old and new. The tension members in the old are all wooden ties, while the tension members in the new truss are iron, except the bottom chord.

The old truss was built about 50 years ago, while the second is about 10 years old, and shows the result of not having any counter-braces. This truss supports an



Roof Trusses in Court House, Portsmouth, Ohio

ordinary hip roof, so situated that the snow is blown from one side and accumulates on the other, thus causing an unequal load of appreciable amount.

The old truss has preserved its shape remarkably well, and is interesting by reason of the peculiar bracing near the abutments. Yours truly,

S. P. Baird,

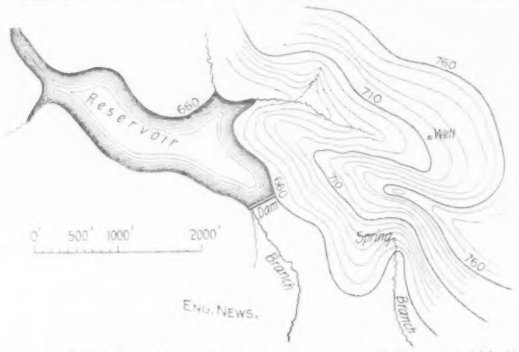
Supt. Portsmouth Street R. R. & Light Co.

Portsmouth, O., March 9, 1895.

POSSIBLE SOURCES OF POLLUTION OF AN UNDERGROUND WATER SUPPLY.

Sir: The city of Charlottesville, Va., employed me to inspect the premises of a fruit grower located in a narrow defile which drained into the reservoir, as shown in the accompanying plan. I found that the well was in some way connected with a spring on the opposite side of a high ridge, and about 1,400 ft. off. If the water in the well is drawn down, the flow of the spring diminishes, and very muddy water in the well will render the spring turbid.

There is no limestone formation here, but the sides



Map of Water-Works Reservoir and Adjacent Well and Spring at Charlottesville, Va

of these mountains are very steep and broken. The spring in question is below the reservoir, but still we see the possibility of a reservoir being contaminated from a foul well, even through intervening ridges, and also that a hydrographic map of this catchment area is not correctly represented by the ridge lines, for at least some of the rainfall eventually finds its way through the ridge into the basin below the dam.

Yours truly, N. Wilson Davis.

Charlottesville, Va., March 2, 1895.

A SCHEDULE OF CHARGES AND CODE OF ETHICS FOR CIVIL ENGINEERS.

Sir: If the civil engineers of the United States wish to advance the interests of their profession, and incidentally their own, and that of their successors, a study of the parallel columns given below may aid them in pointing out the course to be pursued:

(1) Architects have adopted a schedule of charges for professional services. No desire exists among them to change this basis of their remuneration after many years trial of it.	(1) Engineers have not co-operated sufficiently to make the drafting of such a uniform schedule charge possible. The various engineering societies could appoint committees to confer on this subject, and by united action a proper basis of charges for engineers could be formulated.
(2) Architects have adopted a code of ethics for the profession, conforming their action in this respect to the codes that have for long periods of time existed among lawyers and among physicians. See below, one of the last adopted codes.	(2) Engineers have not adopted a code of ethics and so little thought have they given to the subject, or to the desirability of constituting a recognized profession by all proper means at their disposal, that a proposition to establish such a code would strike many of them as novel. A duly delegated conference of committees of engineering societies could formulate such a code.

(3) Architects, as a class, are richer and have a higher standing in the community than engineers. Engineers are mistaken for surveyors, and the name is shunned, instead of being sought after. People doing the work of engineers from choice call themselves professors, promoters, landscape architects, sanitarians, and various other curious appellations.

The Boston Society of Architects, which is also the Boston chapter of the American Institute, has adopted and recommended to its members a code of ethics, as follows:

Sec. 1. No member should enter into partnership, in any form or degree, with any builder, contractor, or manufacturer.

Sec. 2. A member having any ownership in any building material, device, or invention, proposed to be used on work for which he is architect, should inform his employer of the fact of such ownership.

Sec. 3. No member should be a party to a building contract except as "owner."

Sec. 4. No member should guarantee an estimate or contract by personal bond.

Sec. 5. It is unprofessional to offer drawings or other services on approval and without adequate pecuniary compensation.

Sec. 6. It is unprofessional to advertise in any other way than by a notice giving name, address, profession, and office hours, and special branch (if such) of practice.

Sec. 7. It is unprofessional to make alterations of a building designed by another architect, within 10 years of its completion, without ascertaining that the owner refuses to employ the original designer, or, in event of the property having changed hands, without due notice to the said designer.

Sec. 8. It is unprofessional to attempt to supplant an architect after definite steps have been taken toward his employment.

Sec. 9. It is unprofessional for a member to criticise in the public prints the professional conduct or work of another architect except over his own name or under the authority of a professional journal.

Sec. 10. It is unprofessional to furnish designs in competition for private work or for public work, unless for proper compensation, and unless a competent professional adviser is employed to draw up the "conditions" and assist in the award.

Sec. 11. No member should submit drawings except as an original contributor in any duly instituted competition, or to secure any work for which such a competition remains undecided.

Sec. 12. The A. I. A. "schedule of charges" represents minimum rates for full, faithful and competent service. It is the duty of every architect to charge higher rates whenever the demand for his services will justify the increase, rather than to accept work to which he cannot give proper personal attention.

Sec. 13. No member shall compete in amount of commission, or offer to work for less than another, in order to secure the work.

Sec. 14. It is unprofessional to enter into competition with or to consult with an architect who has been dishonorably expelled from the "institute" or "society."

Sec. 15. The assumption of the title of "architect" should be held to mean that the bearer has the professional knowledge and natural ability needed for the proper invention, illustration and supervision of all building operations which he may undertake.

Sec. 16. A member should so conduct his practice as to forward the cause of professional education, and render all possible help to juniors, draftsmen and students.

March 5, 1895. Civil Engineer.

(This journal has at various times given reasons why it believes a rigid schedule of charges for professional services will not apply to the mass of civil engineers. But it believes that consulting engineers or those in independent practice, could and should agree upon some such schedule; and it heartily approves of the formulating and rigid en-

forcement of a code of ethics among all engineers entitled to rank as such. United action on the part of engineering societies in taking up and discussing these subjects should result beneficially to the whole profession, and we should be very glad to see this effort made. We cannot, however, agree with all the statements of our correspondent, and especially deny that the name of engineer is shunned by members of that profession. It is the individual and his professional merit and reputation that command despect; and if the engineer possesses all the requisites he will glory in his professional title, and this title will command the respect due to the bearer of it.—Ed.)

NOTES ON WIND PRESSURE AND SUCTION.

Sir: Mr. O. J. Marstrand, who has communicated to your journal of Feb. 14 an abstract of my experiments on wind pressure, has written me that it would be of interest to have also some later experiments which I have made. I am very well satisfied with Mr. Marstrand's translation of my paper. The more recent experiments have been published in the "'Abstracts of Foreign Papers" of the Institution of Civil Engineers, but some errors occur.

The experiments recorded in Table II., page 110, of the current volume of your journal (Feb. 14) refer to bodies long in proportion to the diameter S. The new experiments refer to bodies short in this proportion. This new table I now send you, and trust that it can be used as an appendix to the article of Feb. 14, 1895.

Yours respectfully, Irminger.

Copenhagen, March 18, 1895.

Total pressure in direction of wind.	Percentage of total pressure. Windward side.	Leeward side.
Ellipsoid with axis parallel to wind, ends sharpened and symmetrical, and length twice the diameter. 0.08 of total pressure on disk, with area equal to cross-section.	7	93
Cube of side S (wind parallel to edge). 0.80 of total pressure on disk, equal to face.	78	22
Cube of side S (wind parallel to diagonal of face). 0.66 of total pressure on disk, equal to face.	45	55
Cylinder of height equal to diameter (wind perpendicular to axis). 0.47 of total pressure on square disk, equal to section through axis.	50	50
Pyramid, square base of side S, height S (wind parallel to side of base). 0.78 of total pressure on disk equal to maximum section perpendicular to wind.	63	37
Pyramid, square base of side S, height S (wind parallel to diagonal of base). 0.55 of total pressure on disk equals the above section.	45	55
Cone, height = diameter of base = S (wind parallel to base). 0.38 of total pressure on disk, equal to maximum section perpendicular to wind.	50	50

GIANTS AND GIANTISM IN STEAM SHOVEL WORK.

Sir: After the publication of such an article as that in your issue of March 21 concerning a "special contractor's shovel," with its claims of novelty, there are doubtless many of your readers who would marvel if a rejoinder were not made by some of those who have been manufacturers of steam shovels for many years. One hundred and seventy thousand miles of railway has not been built in the United States without a good many civil engineers acquiring a considerable knowledge of steam-shovel work and what the machines are capable of. Without a more definite description of the material excavated than that given in the article referred to—"indurated clay," "cemented gravel"—these people would see nothing remarkable in such an average as "594 cu. yds." for a 62½-ton machine, unless established in some different way. To say, for example, that this amount is loaded in shale rock without explosives would be to show that the machine is in advance of what they have done with other shovels for years. Unless it is established in some such way, many of them must feel about the "special contractor's shovel" somewhat as Charles L. Dana, M. D., does about "Giants and Giantism" in his paper on that subject in a recent popular magazine. I quote from it as follows:

> The most efficient work can be got from a medium-sized human machine, as physics and physiology show. . . . . It follows from my view of the case that giantism is not a desirable thing, and may be considered even unsanitary and a legitimate object of attack on the part of students of preventive medicine.

Perhaps the outcome will also be the same; Dr. Dana says: "'The giant, I am sure, dies young." If the description given in the article above referred to will enable any comparison to be made, we beg to submit a generous number of figures of the output of our own shovels of ordinary size, weighing 26 tons. Messrs. Ryan & McDonald, who are far from unknown, say they have used them in the "hardest of indurated clay," and also: "But it must be extremely tough hard-pan which will prevent us handling from 16,000 to 18,000 yds. per month."

More exact figures can possibly be obtained by quoting the following letter from J. C. Hutchins, of the L., N. O. & T. Ry. Co., Memphis: "Beginning April 1 and closing Sept. 15, we loaded with it 83,030 cu. yds. of concrete gravel ballast; and the next year, between corresponding dates, 85,589 cu. yds. of the same material." This would give an average on the last figures of 590 cu. yds. per day. "Concrete gravel ballast" may not be similar material to their "indurated clay and cemented gravel"; but, to substantiate these figures, Dowling & Kennedy, contractors on the D., L. & W. R. R. at Buffalo, wrote us that they loaded in "a stiff clay with considerable small boulders that go through bucket, loaded on flat cars, average monthly record a little over 20,000 cu. yds." The Union Cement & Lime Co., Sellersburg, Ind., wrote: "Have been using an Otis shovel 21 years. We use it to strip a very hard yellow clay—so hard that a very sharp pick makes very little impression on it—from 6 to 12 ft. thick, also 2 ft. of soft shale that is under the clay. Our cement rock is under this. We move on an average 500 cu. yds. per day."

If we may be allowed to encroach on your patience and space a little further, we would like to show what is done in rock work: Chas. McFadden, of Philadelphia, wrote us: "Near Hamburg, Pa., the material was solid rock, requiring the use of steam drills and heavy blasting. The shovel did in that material what I considered admirable work, loading 8,000 to 12,000 yds. per month." Dowling & Kennedy also say: "We have used your machines since 1868, generally in hard digging; some points we note as exceptionally hard. Near Boonton, for D., L. & W. R. R., red sand rock and shale; at Bound Brook, for L. V. R. R., red shale rock; at Factoryville, for D., L. & W. R. R., red clay, with 4 and 5-yd. boulders, and detached ledges of lime rock; Danbury (Rock Hill cut of N. Y. & N. E. R. R.), very bad hard-pan, with boulders up to 5 yds.; near Batavia, for D., L. & W. R. R., blue slate and shale rock, saved and used in masonry. In all these, of course, we used powder, and in some cases high explosives, ahead of the machines." Col. T. H. Rickert, writing from Ovid, N. Y., says: "Have handled as much as 14,000 yds. of solid rock and 19,000 yds. of the hardest kind of hard pan per month of 10 hours per day." J. M. Floesch, Chief Engineer Clearfield & Mahoning Ry. Co.: "Had one of your shovels on our work in a cut 22 to 25 ft. high. The material was from 5 ft. earth, the remainder a shale rock, growing harder as you went to the bottom of the cut. When shook up well with powder, the rock was broken up in small pieces, so dipper picked up same very readily. The shovel took out from 300 to 375 cu. yds. per 10 hours. Capt. John Shields also worked one of your shovels in a 70,000-yd. cut in somewhat harder material, but it was all shale, and not over 6 ins. thick in layers, and was well broken up. It took a large amount of powder to do this, as high as 75 kegs and 200 lbs. dynamite being used for a shot; three holes abreast, 30 ft. back of face. They took out 600 dump-cars per day, working day and night, or about 700 yds. Your shovel will do good work in shale rock when thoroughly broken up."

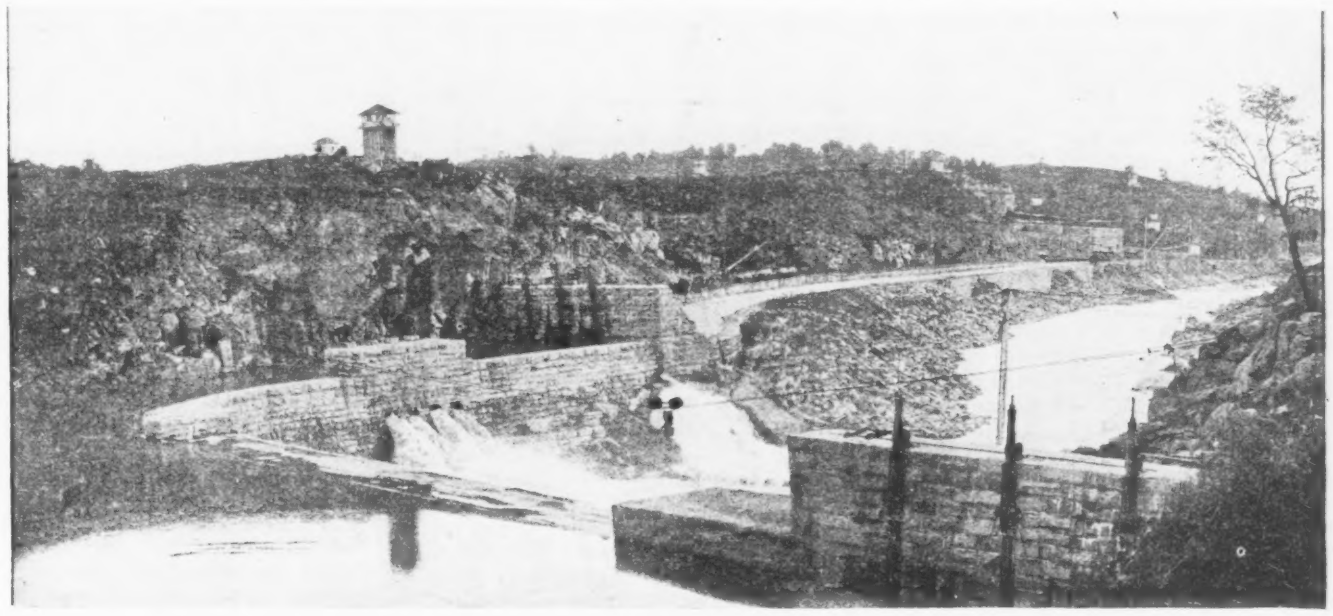
The Bucyrus machine described weighs 62½ tons. A comparison of figures of the cost of operation would probably show that one of them will easily cost $100 per month more to operate than our ordinary shovel. There are people who have great faith that we could build a machine for the hard digging on the Chicago Canal that would dig something. Respectfully,

Jno. Souther & Co.

Boston, Mass., April 3, 1895.

WATER-POWER DEVELOPMENT WITH ELECTRIC TRANSMISSION, FOLSOM, CAL.

The high price of coal and the resulting high cost of steam power on the Pacific Coast have given a great stimulus to enterprises involving the development of water-power and its distribution by electricity in that section, and some of these plants are the most notable examples of electric-power transmission in existence. The latest great work of this class on the Pacific Coast is that which has been in progress for many years at Folsom, Cal., and is now nearing completion. The work was be-



WATER-POWER PLANT AT FOLSOM, CAL. VIEW ABOVE THE DAM LOOKING DOWN THE RIVER.

gun in 1866, when the foundation of the dam was laid, but little more was done. Some years later the state of California granted the Power company certain water-power privileges and lands, and agreed to supply convict labor in the construction of the dam. The work at first involved merely a dam across the American River, near Folsom, and the utilization of the water for power purposes primarily, and secondly, for irrigating the surrounding country. The development of electricity, however, changed all the plans, and these now embrace the utilization of about 5,000 HP. for transmission purposes and the use of 1,200 HP. in the state prison, located alongside a special state power house.

Under the new contract of 1888, the work upon which is rapidly nearing completion, the dimensions of the dam are as follows: The dam, built of granite, laid in Portland cement, is 650 ft. long, 89 ft. high in the center, 87 ft. wide at the base, 25 ft. wide at the crest, and it contains about 48,590 cu. yds. of masonry. It is provided with a heavy wooden flashboard, 6 ft. high, which can be lowered into an opening in the crest at high stages of water. Normally the dam forms a storage basin 3½ miles long. At each side of the dam is a heavy granite bulkhead, each containing three 16-ft. gates operated by hydraulic machinery.

Two canals will leave the dam, one on each side of the river. The one on the west side, intended mainly for irrigation purposes, is not yet complete; but it is designed to be 40 ft. wide on top, 30 ft. wide on the bottom, and 6 ft. deep. The east side canal is finished to the power house, a distance of about 2 miles. It is 50 ft. wide on top, 40 ft. wide on the bottom and 8 ft. deep, with a capacity of 87,600 cu. ft. of water per minute. This canal follows the river-bank, and is partly in rock cut, partly in masonry and partly in earth cuts and fills. Just before it reaches the power house of the Sacramento Electric Light & Power Co. the canal widens into a large basin for holding the logs of the American River Land & Lumber Co., which is about to erect here a large saw-mill. This mill will be operated entirely by electricity.

At the power house there is an available fall of 55 ft. at high water. The water is led to the power house through a rock cut 60 ft. deep by 100 ft. wide, and 150 ft. long. The canal here turns at right angles and widens into a fore-bay 150 × 100 ft. and 12 ft. deep, divided by a central wall into two distinct sections, to admit of cleaning.

The entire mechanical and electric equipment is being put in by the General Electric Co., and the S. Morgan Smith Water-Wheel Co. will put in the hydraulic apparatus. This latter will consist of four pairs of McCormick horizontal-shaft turbine wheels, enclosed in steel cases, with 8-ft. steel inlet pipes, and double discharge tubes. Each pair of wheels will have a capacity of 1,260 HP. at 300 revolutions per minute operating under a head of 55 ft. After passing the turbines the water will be used for irrigating purposes.

The four generators will be of the three-phase alternating current type, furnishing current at 800 volts potential. Each generator will have a capacity of 1,000 HP. and will weigh about 30 tons. In the second-story of the power house, above the dynamos, substation step-up transformers will be installed in which the E. M. F. will be raised to 11,000 volts, and connections will be made to the line through marble switchboards equipped with the necessary switches and fuses.

The pole line will be in duplicate from the Folsom power-house to the Sacramento transformer substation. Each circuit will consist of three bare copper wires supported on specially-designed double-petticoat porcelain insulators. Each insulator is tested, before shipment, with not less than 25,000 volts, alternating current. Each three-wire circuit will carry the output of one dynamo, and any dynamo can be thrown on the line, though they will all be normally operated in multiple.

The substation at the end of the transmission line will contain, in separate compartments, the step-down transformers, delivering current at the secondaries at 125, 250, 500, 1,000 and 2,000 volts, for incandescent lighting and motor service, and three 300-HP. three-phase synchronous motors, connected to a line shaft which will drive several 500-volt continuous-current railway generators and a number of arc dynamos.

GROWTH OF TRAFFIC THROUGH THE ST. MARY'S FALLS CANAL.

The traffic through the St. Mary's Falls Canal in 1894 shows a large increase over that of any previous year, according to the official statistics of the Government officials in charge. In that year over 30% more freight and twice as many vessels passed the canal as were entered from and cleared for foreign countries at the Customs District of New York during the fiscal year of 1893. The general character of the freight, the cost of transportation, size of vessels and other items of interest connected with this immense traffic, with some comparisons with the cost of railway transportation and the traffic through the Suez Canal, are shown in the accompanying diagrams, compiled by Mr. L. C. Sabin, Assoc. M. Am. Soc. C. E., U. S. Asst. Engr., Sault Ste. Marie, Mich.

In explanation of the reliability of the figures upon which these diagrams are based, it may be said that no vessel is allowed to pass the St. Mary's Falls Canal until it has reported on blanks furnished for the purpose, such details as the ports of hail and destination, the kind and amount of freight, the number of passengers carried, etc. At the end of the year these figures are reduced and classified. The rates for transportation are obtained at the end of each season by correspondence with shippers and carriers. For 1893 the replies received probably represented over 75% of the total freight. An average rate for each kind

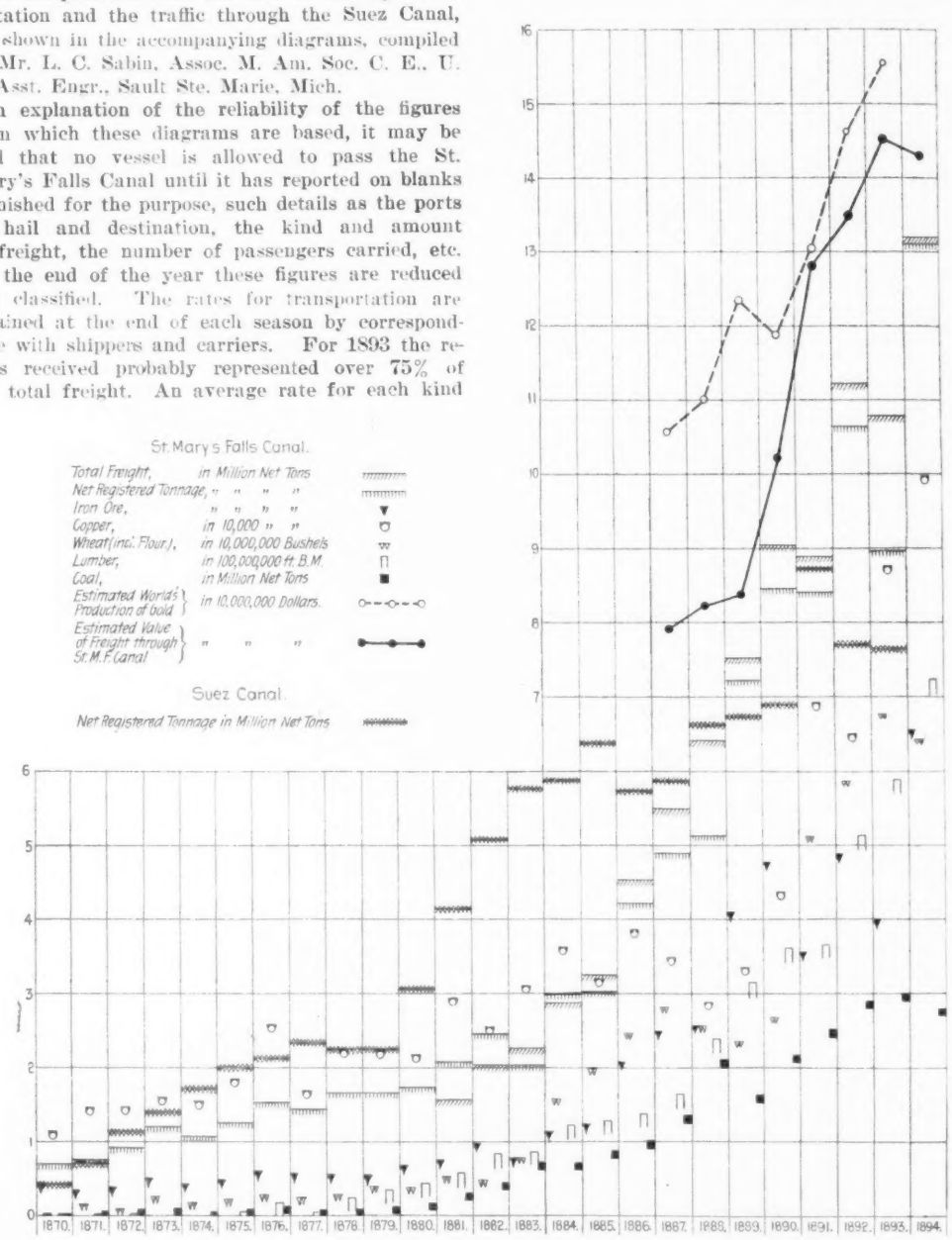

St. Mary's Falls Canal.
Total Freight, in Million Net Tons
Net Registered Tonnage, " " " "
Iron Ore, " " " "
Copper, in 10,000 " "
Wheat (incl. Flour), in 10,000,000 Bushels
Lumber, in 100,000,000 ft. B.M.
Coal, in Million Net Tons
Estimated World's Production of Gold } in 10,000,000 Dollars.
Estimated Value of Freight through St. M. F. Canal } " " "
Suez Canal.
Net Registered Tonnage in Million Net Tons
Tons.
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1870. 1871. 1872. 1873. 1874. 1875. 1876. 1877. 1878. 1879. 1880. 1881. 1882. 1883. 1884. 1885. 1886. 1887. 1888. 1889. 1890. 1891. 1892. 1893. 1894.

FIG. 1. DIAGRAM SHOWING THE INCREASE IN THE PRINCIPAL CLASSES OF FREIGHT PASSING THE ST. MARY'S FALLS CANAL AND THE TOTAL FREIGHT TRAFFIC AS COMPARED WITH THE TOTAL FREIGHT TRAFFIC OF THE SUEZ CANAL FROM 1870 TO 1894, INCLUSIVE.

of freight is obtained by careful inspection of the rates given by the shippers. The dates given in the diagrams concerning the traffic through the Suez Canal have been obtained from the official publication of the Suez Canal Co.,* while the other statistics have been gathered from the "Statistical Abstract of the United States, 1893;" "Commerce and Navigation of the United States, 1893;" "Internal Commerce of the United States;" "Report of the Director of the Mint for 1893."

Diagram 1 shows the growth in traffic of the five principal classes of freight through the St. Mary's Falls Canal and the comparative growth of the total freight traffic on the St. Mary's Falls Canal and the Suez Canal. This diagram explains itself pretty clearly. The traffic of the St. Mary's Falls Canal began to exceed that of the Suez Canal in 1889—if we except the years 1870 and 1871, the first two years after the opening of the Suez Canal—fell slightly below it in 1891, and again largely exceeded it in 1892 and 1893. The comparative size of the vessels carrying this traffic is shown in Diagram 2. It will be noticed that on the Suez Canal there has been very little increase in the number of vessels passing the canal, but that the size of the vessels has rapidly increased during that time, and, indeed, since the opening of the canal; while at St. Mary's Falls the number of vessels passing the canal has increased more rapidly than the size of these vessels. In considering this diagram, it should be borne in mind that at St. Mary's Falls the harbor tugs used in assisting vessels into and out of the lock, and the tugs used in towing on the river, are included in the figures. This, of course, reduces the mean net tonnage of the vessels very much. In addition to this the present lock limits navigation to vessels of less than 16 ft. draft. It may be noted that in 1893 only 4.1% of the freight passing the canal was carried by Canadian craft.

In Diagram 3 the comparative cost of transportation on the Great Lakes and on 18 trunk-line railways is shown. The railways considered include such lines as the New York Central & Hudson River; the Pennsylvania; Chicago, Burlington & Quincy; Illinois Central; Boston & Albany, and Chicago & Alton. In comparing these curves of freight rates by rail and by lake, caution must be taken in drawing any far-reaching conclusions. The freight carried by the 18 trunk lines, of course,

* Le Canal de Suez Bulletin Decadaire de la Compagnie Universelle du Canal Maritime de Suez.

includes all classes of goods, much of which is perishable or requires rapid transit for other reasons, and for transporting which larger rates are charged than for carrying wheat, coal, etc. An examination of the statistics relating to the lake traffic as given in these diagrams shows that of the 13,195,860 tons passing the St. Mary's Falls Canal in 1894, 12,743,675 tons, or over 96%, consisted of ores, grain, lumber and quarry products. The rail rates on these materials on the trunk lines named above will fall far below the average rate for all classes of freight as given in curve A. This is clearly brought out in the diagram itself, where the rate on wheat between Chicago and New York by railway is compared with the lake rate on the same grain from Duluth to Buffalo. For making comparisons between rail and lake freight rates the curves C and D should be used as in all respects preferable to curves A and B. A much more careful analysis of railway and lake freights must be made before any detailed conclusions can be drawn from these curves, but with the above warning in mind, the curves are comparable in a general way. Curves H and I are of more value, as they show very clearly how lake rates have decreased since 1887. Roughly stated, two tons of freight could be carried one mile in 1893 for the same money that one ton could be carried one mile in 1887.

From these diagrams an unusually clear idea is given of the immense growth of our lake traffic in a little over two decades. Since 1880, even, the increase in the tonnage of freight carried has been over 735%. As giving some interesting comparisons with the extent and value of this carrying trade, we add the following excerpt from a letter from Mr. Sabin:

In this connection it may prove not without interest to make a few comparisons between the amount and value of this carrying trade and some other things which are more familiar or more easily to be comprehended. The total tonnage of the sailing and steam vessels of the merchant marine of the United States in 1893 was 4,825,071, or less than one-half of the freight tonnage passing St. Mary's Falls Canal in that "off" year. The St. Mary's freight in 1894 was equal to the total foreign tonnage entered at all the ports of the United States from foreign countries in 1893. The total tonnage entered from and cleared for foreign countries at the Customs District of New York for the fiscal year ending June 30, 1893, was 7,015,030, and the number of vessels was 5,037. Comparing these with the similar quantities for St. Mary's Falls Canal we see that the latter passed 30% more freight and more than twice as many boats. In 1892 there were 1,168,849 freight cars on the railways of the United States. Every car would be required to carry more than 10 tons of freight in order to carry the amount passing the canal in 1894. The amount of coal passing the canal in 1893 was more than all the coal exported from the United States in that year. The lumber passing in 1893 was nearly equal to the lumber of domestic production exported. The wheat produced in the United States in 1892 was 515,949,000 bushels. The amount consumed in the United States during the fiscal year ending June 30, 1893, was 324,431,740 bushels, and the amount of domestic wheat exported was 119,912,633 bushels. Thus the wheat (including flour) passing the canal in 1893 was 12% of the production, 20% of the consumption, and 56% of the exportation. Or, in other words, the wheat passing the canal in that year was sufficient to supply bread to all the people in the United States for about two and a half months. Passing to the estimated value of the freight in 1893, it was in excess of the estimated value of the state of Vermont, including real estate and improvements; more than 1¾ times the total expenditure of the post office department of the government; more than 90% of the value of the world's production of gold, or of the total value of exports of domestic manufactures from the United States, or of the amount expended for public schools in the United States, or of the amount paid in pensions in that year. If to the value of the freight were added the value of the craft engaged in the transportation, any of the above-mentioned items would be far outstripped.

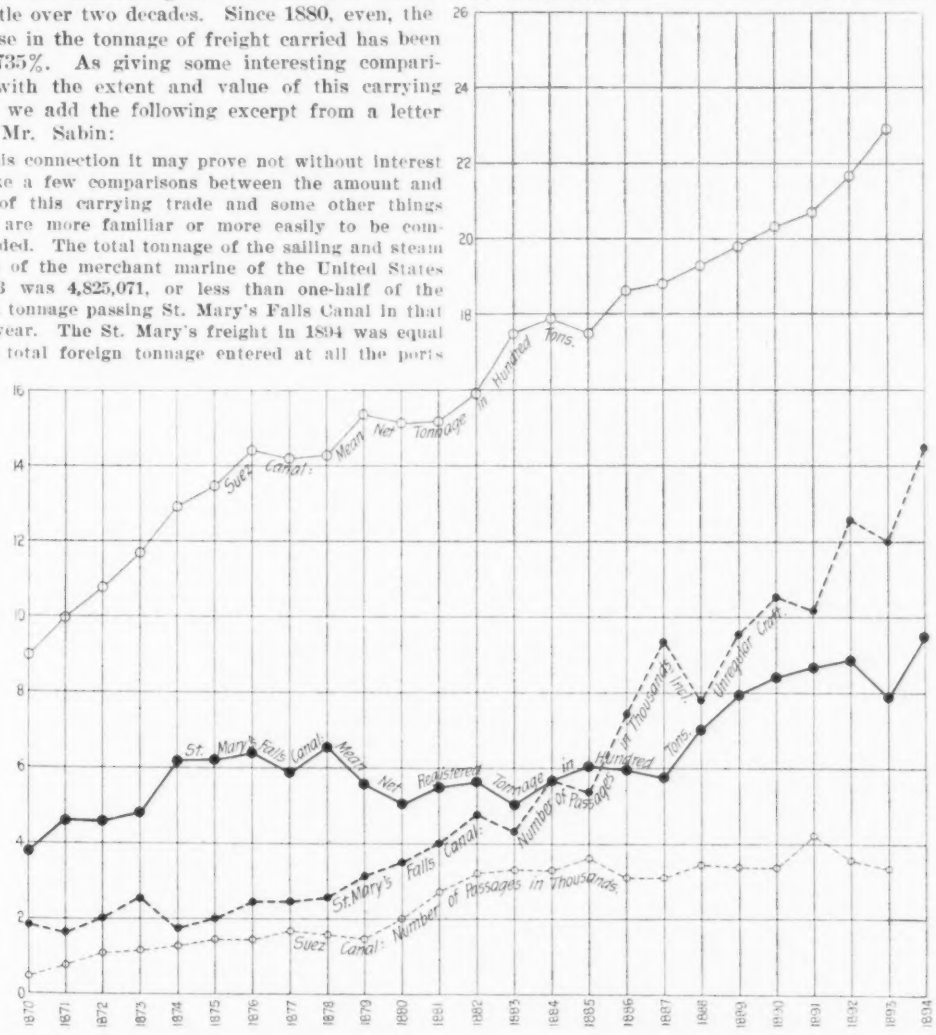

Hundred Tons.
Suez Canal: Mean Net Tonnage in Hundreds.
St. Mary's Falls Canal: Mean Net Registered Tonnage in Hundreds.
Number of Passages in Thousands.
St. Mary's Falls Canal: Number of Passages in Thousands.
Suez Canal: Number of Passages in Thousands.
Tons.
Unregister Craft.

FIG. 2. DIAGRAM SHOWING COMPARATIVE SIZE AND NUMBER OF VESSELS PASSING THE ST MARY'S FALLS AND SUEZ CANALS FROM 1870 TO 1894, INCLUSIVE

MEXICAN INTERNATIONAL EXHIBITION FOR 1896.

Mexico is to hold its first great international exhibition in 1896, and the city of Mexico has been selected for the site, the grounds, which have an area of 600 acres, being situated below the castle of Chapultepec, on the avenue De la Reforma, within ten minutes' ride from the center of the city, readily accessible by steam railways, the street car lines and by drives. There will be three main courts—the Mexican National Court, the Grand Court and the Foreign Court. In the first will be the Government Building, National Palace, Administration Building of the National Department and special buildings for the 28 Mexican states, the Spanish and Moorish styles of architecture predominating. The Grand Court will be mainly of a decorative character, and in the Foreign Court there will be the Manufactures and Liberal Arts, Transportation and Electricity, Agriculture and Horticulture, Machinery, and Administration buildings, generally designed in the Renaissance style. It is stated that the Mexican Exhibition Construction Co. will purchase the entire tract of 600 acres, with a view to making it a permanent addition to the city, and laying it out eventually as a handsome residence district, with parks, etc. The buildings will be constructed with a view to their being disposed of after the close of the exposition for hotels, public institutions, factories, warehouses, etc., and it is expected

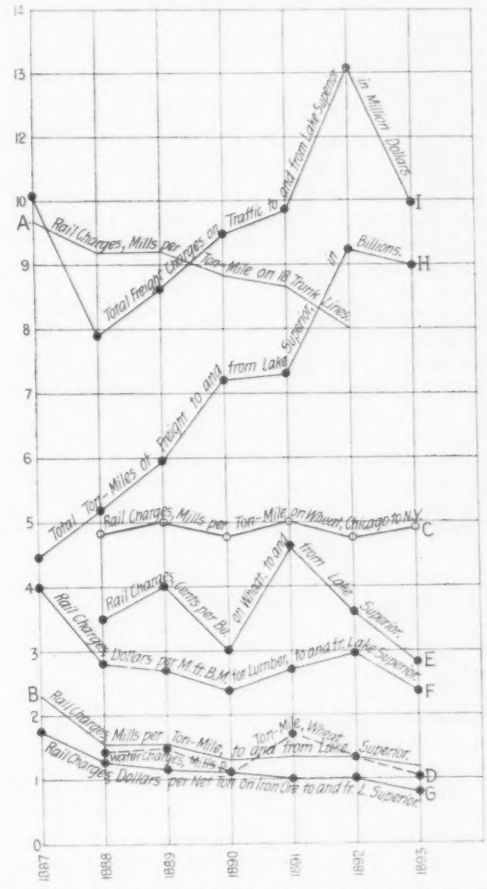

In Million Dollars.
Rail Charges, Mills per Ton-Mile on 18 Trunk Lines.
Total Freight Charges on Traffic to and from Lake Superior.
In Millions.
Total Ton-Miles of Freight to and from Lake Superior.
Rail Charges, Mills per Ton-Mile on Wheat, Chicago to N.Y.
Rail Charges, Mills per Bu. on Wheat, to and from Lake Superior.
Rail Charges, Dollars per M. ft. B.M. for Lumber, to and fr. Lake Superior.
Rail Charges, Mills per Ton-Mile, to and from Lake Superior.
Ton-Mile, Wheat, Other Charges, in Mills.
Rail Charges, Dollars per Net Ton on Iron Ore to and fr. L. Superior.

FIG. 3. Diagram Showing Comparative Lake and Railway Freight Rates for 1887 to 1893, Inclusive, as Determined by Traffic Passing the St. Mary's Falls Canal.

that there will be a good demand for the structures under the existing conditions of construction in that country. There will be an electric light plant (which will be used permanently by the company), an electric railway, water and gas supplies, steam and electric power, etc.; and there will, of course, be innumerable minor buildings and attractions, concessions and a "Midway Plaisance."

The special police and fire protection systems, and the military guard, will be under the direct supervision of the government. Special railway and steamship rates will be made for passenger and freight traffic, and all exhibits will be considered as bonded goods, with duty payable only in case of sale. The materials and machinery for the building will be admitted free of any duty. The general administration will be in the hands of a company organized by Mexican and foreign capitalists, with a capital stock of $500,000. Mr. Ygnacio Bejarano, official mayor of the Federal government, will be Director-General, and Mr. R. de Cornely will be in charge of the Foreign Department. Mr. A. K. Koney, Consul-General of Mexico at San Francisco, and President of the American-Mexican Exposition Co., has requested the governors of the several states of the Union to appoint State Commissions, and some of these commissions have already been appointed. It is also proposed to organize in Chicago a company to construct the main buildings and carry on a general construction business in connection with the exhibition. All information can be obtained from Mr. Koney, at San Francisco, Cal., or from Mr. Felipe Berriozabal, Mexican Consul, 126 Washington St., Chicago, Ill.

THE PNEUMATIC TELEGRAPH IN PARIS.

The transmission of card telegrams and the distribution in the city of Paris of telegrams from outside the city by compressed air have been in successful operation since 1866. This pneumatic-tube service was originally introduced into London in 1858; into Paris and Berlin in 1866, and into Vienna in 1875. It is also used to some extent in Lyons and Marseilles.

At the present time there are 156.12 miles of these pneumatic tubes in Paris, of which 123 miles are 2.6 ins. in diameter; 17.8 miles are 3.15 ins. diameter, and 15 miles are in subterranean conduits. There are 105 postal bureaus in Paris, of which all but one are equipped with the pneumatic tubes. The total cost of construction to date is about $1,544,000.

During 1893 4,097,667 card telegrams and 13,766,451 telegrams were carried. The gross revenue from telegrams was $304,211, and the total expenses of operation were as follows: Production of motive power, $57,900; repairing lines and apparatus, $14,475; personnel of operation, 411 persons employed, $113,870; total, $186,245. This shows surplus earnings on the telegram account alone of $117,956.

The length of a message sent in this way is only limited by the space allowed on the telegram card, and as the sealed telegram costs only 50 centimes, or 9.65 cts., for any number of words within this limit, the service is much cheaper in the city than the electric telegraph, and the message reaches its destination almost as quickly.

In the "Consular Reports" for January, 1895, U. S. Consul-General Samuel E. Morss, of Paris, presents a map of the pneumatic system in that city and describes, somewhat hazily, the operation of the lines. It is sufficient to say here that these lines are made of mains and branches of the sizes given above, with two chief centers of distribution, one near the Bourse, on the right bank of the Seine, and another center on the left bank. The compressed air, furnished solely by steam power, comes from seven power houses scattered about the city. The tubes used are wrought iron, connected by flanges and bolts, and located as much as possible in the sewer system of the city for ease of access in case of stoppages, etc. The messages, to the number of 30 to 35 in each box, are sent in sheet iron tubes fitted with leather collars, which latter are usually renewed after travelling about 1,250 miles. These boxes are often sent in trains of ten, which, with a special piston-box, or driver, weigh 8.12 lbs. all together. Each box is stamped with a number, and the name of the station, for ease in distribution. The detail of the station apparatus is somewhat complicated, and needs drawings to describe it intelligently. The report of operation indicates few stoppages or accidents in transit. In case of stoppage the point of obstruction can be located by special apparatus within a distance of 30 m., and increased air-pressure, jointed 60-yd. rods, or the removal of a section of pipe must be resorted to. Stoppages due to the freezing of the waters of condensation are usually overcome by sending to the spot a piston filled with hot water.

SURVEYORS' FEES IN WASHINGTON, D. C.

The Commissioners of the District of Columbia, in accordance with the requirements of the Act of Congress of Feb. 25, 1895, have prepared a new schedule of fees to be charged by surveyors in the District. This schedule is given as follows in the Washington "Star":

1. For preparing for record a plat of the proposed subdivision of any recorded lot, or part of lot, 50 cts. for each lot in the new subdivision.

2. For preparing for record a plat of a proposed subdivision containing one or more squares, not more than $20 shall be charged for the subdivision of each entire square.

3. For recording the above plats, after approval by the commissioners of the District of Columbia, $2.50 for each square, and $1.50 for any lot or part of a square.

4. For furnishing a copy of the plat and record of any square or part of a square, $2.50.

5. For examining any plat and calculating the area of any proposed sublot, 25 cts.

6. For preparing plats showing lines of any proposed minor street or alley, to accompany petition for condemnation, $5 for each plat.

7. For surveying and marking upon the ground the boundaries of any lot within the city of Washington east of Rock Creek, $3; within the city of Washington west of Rock Creek, $4; in the District of Columbia, outside of the city of Washington, in any subdivision recorded since 1888, and the lines of which are duly marked by stones approved by the surveyor of the District of Columbia, $5.

The above shall include a certified plat of the survey for the property owner or applicant.

8. For surveying and marking upon the ground the boundaries of any piece of ground in the county of Washington not contained in a subdivision recorded and marked as stated in paragraph 7, $25 per day for each day occupied in field work and $10 per day for each day occupied in computing lines, areas and other office work.

9. For surveying and ascertaining the position of walls of any building with respect to the lines as laid down on plat of record in the surveyor's office, or according to description contained in deed, $5 if building stands on a single lot; $7.50 if building stands on two lots, and $10 if building stands on three or more lots.

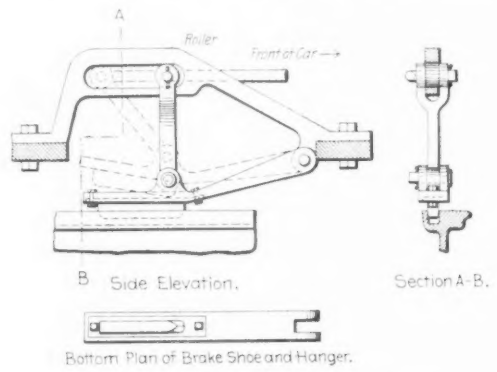
10. For surveying the foundation walls of any building when the same shall have reached the level of the street or alley upon which it is built, $2.50.

For any work not specifically described above, the actual cost of labor and material will be charged.

No work will be begun by the surveyor for any private parties until the actual estimated cost of the same has been deposited with the collector of taxes of the District of Columbia and his receipt recorded in the office of the surveyor of the District of Columbia.

THE PROUTY TRACK BRAKE FOR CABLE CARS.

We illustrate herewith a track brake for cable cars which is being tested on the North Chicago and West Chicago cable railway lines in Chicago. The brake is the invention of Mr. Enoch Prouty, of Chicago, who was appointed by the city authorities a special commissioner to investigate track brakes shortly after the fatal accident to a runaway train in the Washington St. tunnel, which

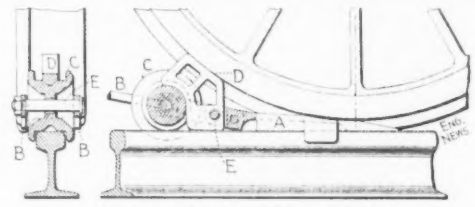


The Prouty Track Brake for Cable Cars.

was noted in our issue of Dec. 11, 1894. The construction and operation of the brake are so clearly shown in the illustration as to make detailed explanation unnecessary. It consists simply of a steel shoe, which is forced down in the groove of the track rail by means of a lever placed at the head of the grip car near the levers for operating the grip and the wheel brakes. This shoe, it will be noticed, is not intended to bear on the bottom of the groove, but to wedge into it and press against its sides, and is made so that it can be replaced by a new shoe as the wear necessitates a change. Two brakes are placed on each grip car between the front and rear wheels on each side, and both are operated by a single lever. This brake has been in operation on two grip cars running through the Washington St. and La Salle St. tunnels in Chicago for several weeks, and has worked successfully under all conditions. In a series of tests witnessed by a member of the staff of this journal, the grip was released on the incline, and the train allowed to gain headway running both forward and backward, when an application of the brake stopped it within a few feet and without any very noticeable shock or jar. We are indebted to Mr. Prouty, whose office is at 334 Dearborn St., Chicago, for the drawings from which our illustration has been prepared.

GERMAN PORTABLE ROLLING STOP BLOCK.

In discussing the serious accident on a Brooklyn elevated railway in which the fixed bumper at the end of the structure was knocked down (Eng. News, Jan. 17), reference was made to the necessity of providing an auxiliary stop-block ahead of the permanent bumper, such, for instance, as some form of yielding portable stop-block. We illustrate herewith a device of this kind, which is said to be giving good results on a number of German railways. It consists of a pressed wrought iron tongue, A, resting on the rail, and connected by



German Rolling Stop Block.

the loop or strap, B, with a small, grooved, easily-turning steel wheel, C. Between the end of the tongue, A, and the wheel is the wrought iron brake-shoe, D, which is pivoted on the bolt, E, and bears in a groove turned in the tread of the wheel. When a car wheel runs up on the tongue, A, the block, D, acts as a brakeshoe to stop its revolution, while the force of the blow carries the stop-block back along the rail until it comes gradually to a stop, without shock, being guided by the grooved wheel and the ears or lugs on the tongue piece. The device weighs about 30 lbs. and costs about $5. It is manufactured by the patentee, Arthur Koppel, of Bochum, Germany. A somewhat similar device is manufactured by W. Pitzner, of Laurahutte, Germany.

FERNOLINE FOR PRESERVING WOOD.

One of the most extensively used of the wood preservatives which are applied in the same way as ordinary paint (that is, without any special treatment of the timber), is fernoline, which is a product of the destructive distillation of yellow pine, and is said to be composed of 50% wood creosote, 40% oil of tar and 10% of pine tar. As already stated, it is used in the same way as paint, and has been applied to trestle and bridge-work (especially at joints and bearing surfaces), blocking and stringers for platforms, the sheathing of ferry-boats and barges, and also to bridges, piers and similar wooden structures. The Pullman Palace Car Co. and several railways employ it in car construction, the specifications requiring it to be used on all tenons, mortices, shoulder and shoulder-seat of tenons, sills, and between double roofs and floors; also in all passenger and freight car and tender work where two pieces of wood touch each other, on the floors of all stock and manure cars, and on that part of the tender floor covered by the tank, and generally on tenons and joints where it will not interfere with the paint. From one to three coats are used, according to the facility with which the material is absorbed. It is manufactured by the Fernoline Chemical Works, of Charleston, S. C.

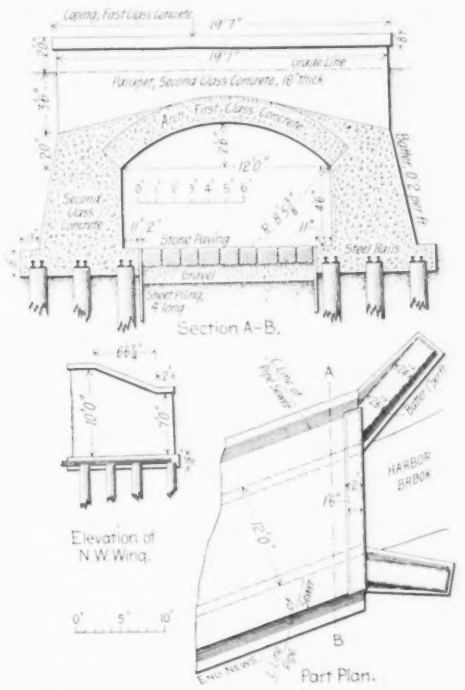
A RECORD FOR FAST RIVETING AT THE ELMIRA BRIDGE WORKS.

A fast-riveting record was made at the North Side Works of the Elmira Bridge Co., Elmira, N. Y., on March 27, when 12,648 rivets were driven by a single machine in 10 hours. The rivets were ¾-in. diameter, 2⅛ and 2⅜ ins. long, pitched 2½ to 6 ins.. The holes were punched and reamed and the work was riveting angle irons 3 × 3 × ⅜ in., 28 ft. long, to plates ⅜ in. × 16 ins. and 28 ft. long. In all 98 pieces were handled. The rivets were driven by a direct-acting steam-riveting machine, using steam at 100 lbs. pressure. The work was for the Park Ave. viaduct of the New York Central R. R., in New York city. We are informed that the best previous record was made at the Union Bridge Co.'s works, at Athens, Pa., in 1886, or 1887, where 10,000 rivets were driven by machine in 10 hours, this record having now been broken by

2,648 rivets by the work above recorded. It is hardly necessary to say that such work can only be done with all operations conducted with the regularity of clockwork and all the men working at their best.

CONCRETE ARCH CULVERT OF 12 FT. SPAN.

The use of concrete in engineering work as a substitute for stone or brick masonry is rapidly increasing, and we show herewith a 12-ft. arch culvert of concrete, built over Harbor Brook, at Richmond Ave., Syracuse, N. Y. The culvert is built on a skew, and has a length of 49 ft., with short wing walls at each end. The side walls are founded on piles capped by steel rails, and the construction is clearly shown on the cut. The concrete is composed of broken stone, sharp sand and



Concrete Arch Culvert; Syracuse, N. Y.

Empire Portland cement. The structure contains 300 cu. yds. of concrete, and cost about $2,000, exclusive of the foundations. Another arch of 6 ft. span, near Syracuse, which was built in 1887, is said to be as good now as when first built. The concrete is placed in cribbing sheathed with plank, and after this has been removed the surface is plastered with a mixture of 1 part of Portland cement to 2 parts of clean, sharp sand, which is then scribed off to imitate stone coursing. Both of these arches were built by Martin & Sullivan, contractors, of Syracuse.

COST OF STREET CLEANING IN VARIOUS CITIES.

The cost of street cleaning in various cities of the United States has been compiled by Mr. Thomas Macklin, Superintendent of Street Cleaning in St. Louis, Mo. The following table gives a summary of the figures obtained:

	Paved sts., miles.	How swept.	Cost, per mile.	Appropriation.
Baltimore	44.93	By machine and hand	.....	$131,508
Boston	85.73	Machinery—"Block Patrol" system used	$18.97	289,320
Chicago	778.12	Swept by contract	18.70	304,364
Brooklyn	381.83	Contract work and by hand	22.60	365,000
Denver	14.00	Swept by machines	.....	18,000
Washington	164.72	Swept by machines—contract	.24¼	.....
			1,000 sq. yds.	
New York	385.00	Hand labor and machinery and removing sweepings	18.21	2,250,000
Omaha	76.83	Swept by machines—contract	17.99	.....
Philadelphia	733.40	Swept by machines—"Block Patrol" system	.....	503,651
Pittsburg	181.98	Machines	.....	103,343
San Francisco	130.00	By hand	16.40	120,000
St. Louis	63.00	Machines—per mile swept	8.50	72,900
	Paved alleys.			
St. Louis	91.00	By hand—per mile per annum	134.00	.....
	Macadam.			
St. Louis	304.00	By hand—per mile per annum	380.00	128,000

MODERN PRACTICE IN SIGNALING.

The protection afforded by modern block-signaling systems was discussed in an interesting and instructive manner at the March meeting of the Western Railway Club by a number of prominent motive-power men and signal engineers. This discussion was brought out by the paper on "Modern Practice in Signaling," read at the February meeting of the club by Mr. George Gibbs, M. Am. Soc. M. E., Mechanical Engineer, Chicago, Milwaukee & St. Paul Ry., and published in our issue of March 14, 1895. We abstract this discussion as follows:

Mr. F. A. Delano (C., B. & Q.).—The cautionary signal deserves more consideration than is given to it. This signal is used to mean two or three different things. When it is used in block-signal practice it means that there is a train in the block, and that the engineman can run at speed so long as he sees the block ahead of him clear. In nine cases out of ten, when an engineer enters a block displaying a cautionary signal, the train which precedes him, and whose presence in the block is denoted by the cautionary signal, has left the block before he sees it, and he maintains speed entirely through the block. In time the cautionary signal gets to mean very little to the engineer on account of this fact. At an interlocking tower, governing switches, and crossings, the cautionary signal means that the engineman must stop before he gets to the home signal. As the interlocking devices are so arranged that the operator is not compelled to clear the cautionary signal when he clears the home signal, it is, however, common to find the cautionary signal never cleared, or cleared too late to be of use. I know one signal tower in the city of Chicago where it is commonly said that the cautionary signal has not been cleared for years. I do not mean to give the impression that distant signals should be done away with in this country, but I mean that these signals should be made to mean more to the engineman.

Mr. H. M. Sperry (National Switch & Signal Co.).—There is a strong feeling that the distant signal is of little use, which is due to the fact that such signals are not properly operated. The fact that a distant signal is put up for a certain purpose is disregarded, and it is allowed to remain at caution for years. If trains are to be run at a high speed, we must have distant signals. As to the question of red and green lights, the substitution of green for white for night signaling does not seem to me to be such an easy problem as it would appear on the surface, owing to the difficulty of providing a color or combination of colors for the caution signal. We require a distant signal and a permissive block signal, although when we use a permissive block signal we simply abandon the block system, and tell the engineman that the block system is abandoned, and he must look out for himself. If he can see the other end of the block he does not slack speed. We have only three colors—red, green and blue. I do not believe amber can ever be used as a color for signaling, as it so closely approaches white. There are possibly some shades of amber that can be used, but I think in practice it might be a question whether the light was amber or white. This compels us to use a combination of colors, and red and green seem to be the best for this.

Mr. John Fultz (C., M. & St. P.).—As an engine runner, I prefer green light for safety. There are so many white lights that it is impossible sometimes to tell a signal light from something else. I run more easily, also, when I have a positive signal stating it is safe, not assuming it as safe because no signal is shown.

Mr. W. J. Gillingham (Sig. Engr., Ill. Cen.).—On the question of automatic signaling, an idea seems to prevail in many quarters that, as there is no check upon their observance, enginemen will purposely disregard them, in violation of rules as to the time they shall wait at a "danger" signal; and this idea would appear to be based on the assumption that an engineman's first consideration is for the prompt movement of his train, safety being of secondary importance. There is, I think, very slight warrant for assuming such a condition of things, it neither being borne out by actual working of trains under such a system nor by any exhibitions of willful neglect to obey signals.

On all the automatic systems—and the manual-controlled as well—nothing will prevent an engineman disregarding a signal, if so disposed, excepting such systems as depend upon a device for controlling the brakes, taking the control of the train momentarily out of the hands of the engineman; and I question whether such a method is not a step backward, tending as it does to encourage a lack of watchfulness of the condition of the track ahead. The most important system of this kind is the Kinsman, and while its claim to notice is based chiefly on the device above mentioned, I believe that visual signals can be used in connection therewith. Another very strong objection to any controlled-brake device lies in the expense of equipping engines, and this would work to great disadvantage on large terminals over which many foreign engines might pass.

As to the efficiency of the automatic block system, it may, I think, be fairly stated that the liability to derangement and the delays arising from such derangement are no greater than with the controlled manual.

It may be assumed that signal companies installing their systems would have sufficient faith in them to do away entirely with the permissive block; and to all intents and purposes they are operated as absolute block systems, the only difference being that in the event of a signal being out of order, movement under it is controlled by rule—in other words, if the signal remains at "danger" for a prescribed time, it is for the time regarded as a caution indication, and the train proceeds, under control. On some roads the rule requires that the flagman shall precede the train in such cases, until the first "clear" signal is reached, and this rule is very generally enforced in thick or foggy weather.

With the controlled manual system the permissive block is accomplished by the use of clearance cards, and after the train has passed the block station there is no more warrant that the speed will be controlled than with the automatic. The cost of the controlled manual system and of its operation is so great that in most cases it is entirely out of the reach of railways contemplating blocking; while the automatic system, relatively speaking, is within the reach of any road; and it affords, when properly installed, not only train protection, but protection to switches as well.

The success of a signal system automatically controlled depends in a very great degree upon careful maintenance, and, as stated in the paper under discussion, nothing could be further from the truth than that an automatic system is one which "takes care of itself." Failures in automatic systems controlled by track circuit are due more to battery defects and those caused by trackmen's carelessness than to any other cause. In 1894, on 128 signals controlled by track circuit there were 90 failures due to various causes out of a total of 4,793,184 signal movements, divided as follows: Failures of apparatus, 30; neglect signal maintenance, 27; roadway department neglect, 23; sundries, 10. All these signals are cared for by three inspectors and four battery men.

Mr. W. B. Turner (C. & W. I. Ry.).—There is another point that has been overlooked in this discussion, and that is, the subject of uniformity in signals and position. We should always make our signals so plain that an engineman approaching may easily distinguish his signal and what that signal is for. The color of lights is something that I am not yet satisfied with. The question seems to narrow itself down in railway signaling to two colors, or three colors—if white is abandoned, then two colors, red and green; or red, white and green, as in practice now. As we have three indications, if we abandon the white, we must use a combination of the two for caution, or get some other color to indicate caution. But in regard to position, it seems to me that here is a point that is of the utmost importance, especially in terminals and yards where we have, maybe three, four, five or six tracks side by side. The position of the signals is of the utmost importance to the engineman. He wants to know, as he comes down through a yard, just what signal is for him, and this he can determine most easily by knowing that his signal is always in a certain position relative to the track, and on the right hand side, of running direction. To obtain this in many places it is difficult. Where the track centers are such that we cannot place signals between tracks, it seems to me we should erect bridges. The location of the signal is as important as the color of the light. I think an engineman should be able to know, when he comes to a signal, what it is, without having to stop and analyze it and consider whether it is the one he wants or not.

Mr. A. H. Rudd (N. Y., N. H. & H.).—It seems to me

that the most perfect signal is a combination of color and position—that is, the use of both position and color for both day signals and night signals. On the Boston & Albany R. R. the cautionary signal for night is two horizontal green lights; the clear signal, two vertical green lights, and the danger signal two horizontal lights other than green, red being supposedly used, but a broken glass in a home or distant signal still indicating danger. This means, of course, greater cost of maintenance, two lamps for each main line signal and more complicated mechanism, but gives greater safety and easy reading. It seems to me that the best night signal code is: Red light on high signal; purple light on low signal; white light on any signal and absence of light on any signal all mean danger. Green light means caution. Two vertical green lights mean clear. For day signal arrangement I would suggest the following: Home signal as at present; distant signal same shape as at present, but painted yellow with black stripes. Advance signals to consist of disks, and the top arm of the home signal governing the main running route instead of governing to the right, as is the practice on this road and others in the East. This is a most important point which Mr. Gibbs failed to touch upon. I would amend his suggestion in regard to protection of isolated facing point switches by going still further and saying that all isolated switches should be protected, and all facing switches should have some form of distant signal.

In regard to the auxiliary track circuit at interlockings, for preventing change of combination, I would say that the Old Colony R. R. used this device so that as soon as a train had passed the distant signal the route was locked and kept so until the advance was passed, with the result that shifting movements were rather difficult, and the delays at railway grade crossings were numerous.

Mr. Gibbs thinks the Sykes system, with releasing track sections, would be nearly perfect were it not for the practice of permissive blocking. The Hudson Division of the New York Central is the most perfectly-protected piece of track, probably, in the United States. The permissive block is not used, and yet the system is far from perfect. I found that the great danger was the possibility of the forward part of a broken train releasing the plunger and permitting the admission of a second train, with the rear part of the first still in the block, throwing upon the operator the responsibility of determining if the entire train had passed. Another weak point was the issue of clearance cards, made necessary by the large number of signal failures, due to various causes, and making the system at times in reality a permissive block.

I radically differ with Mr. Gibbs as to the great objections to automatic systems (or, at least, to one system). I have at present charge of the Hall signals on the Hartford Division of this road, and can say that, as far as our experience goes, neither of his objections holds good. This system can be installed on a track circuit as cheaply as any manual-controlled, and the liability of its getting out of order is less than with any other system known to me. We have 93 of these signals on this division, most of them operated by track instruments, a few by track circuit, and some by a combination of both. These are maintained by six men, and during the first 15 days of March we have had five failures; two, cause unknown; two, trouble on track circuit; one, broken push button, causing seven trains to stop; showing, I think, that this system is the best yet devised for maintenance and certainty of operation. If any manual-controlled system can give evidence of better work, I would be glad to see it.

The Hall system has, however, two most serious defects. One is the form of its signal, which prevents its being seen far under certain conditions of light and atmosphere (although under other conditions it can be discerned one and a half or two miles away). The other is the feature which is shared by all automatic systems—i. e., its use as a permissive block, the universal practice, as far as I know it, being that a red automatic means two or three minutes' delay and then a cautious advance.

Mr. A. T. Dice (Atl. Cy.).—As to the multiplication of signals being in itself no source of danger, the position taken by Mr. Gibbs is entirely right. In the installation on the New York Central, on the Hudson River Division, we put in 102 signal stations in 139 miles. At all of these were home and distant signals, and at many of them advance signals. Some of the officers feared the condition spoken of; but after the signals were in operation a short time, all were agreed upon the wisdom of having the road properly and fully signaled. Probably six months after they were in operation, one of the best and most intelligent runners on the road said to the superintendent that he would now as soon part with his air-brake as he would with the block signals.

There is to my mind no practical reason why signal indications should not be given during the day by position and at night by color. Should we get the ideal night position signal that so many have been striving for, I do not believe that we would have advanced any. There is undoubtedly a strong feeling in the American Railway Association in favor of red for danger, green for clear, and combination red and green for caution. There is also a strong feeling in the Association in favor of but two indications, red for danger, green for clear, making the light on the distant signal red (the distant signal when used is really the governing signal) and giving trains the right to enter a block already occupied only by order or hand signal, as may be ruled by each road. The reason for advocating but two colors is on account of the lack of a third color that is satisfactory, and not all agreeing on the combination of red and green for caution.

The classification of signals given is more elaborate than is necessary, as signals protecting switches, drawbridges, etc., do often protect the rear end of a train as well, and when necessary to give a danger indication it is perhaps best to give "danger" without attempting to fully convey to the engineman the nature of the danger.

I cannot agree that the automatic is the most modern refinement; at the same time, I believe in it thoroughly. The manual-controlled, as developed in recent installations in America, is undoubtedly the most perfect system yet used. It does not admit of permissive blocking (in fact, I know of no manual controlled systems that do), and in it all switches remote from signal stations are electrically connected and interlocked with the block instrument at the adjacent signal station. The track circuit in the latest manual controlled is really the essential feature, acting as a check upon the signalmen and not allowing them to admit a train to an occupied block, except on written order or hand signal, though both should err and attempt to do so. It is also applicable to single-track working; as, for example, the New York Central between Tonawanda and North Tonawanda, N. Y., operates a block of single track with it over which a large number of trains are passed daily, and with entire success. Generally, however, the cost of the manual-controlled system, in its installation, maintenance and operation, is practically prohibitory, except upon very busy roads, and where a large number of interlockings are necessary.

LEGAL DECISIONS OF INTEREST TO ENGINEERS.

Special Assessments on Unsubdivided Tract.

The only foundation for a local assessment lies in the special benefits conferred upon the property assessed by the improvement, to pay which the assessment is made; and an assessment beyond the benefit so conferred is a taking of property for public use without compensation, and therefore illegal. Under the law relating to cities of the metropolitan class, where an improvement extends through an unsubdivided tract of land, such tract is not subject to local assessment to pay for such improvement to a greater distance from the improvement than the average distance to which assessments on subdivided lots are levied.—Cain v. City of Omaha (Supr. Ct. of Neb.), 60 N. W. Rep., 368.

Liability for Defective Sidewalk.

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that the most perfect signal is a combination of color and position—that is, the use of both position and color for both day signals and night signals. On the Boston & Albany R. R. the cautionary signal for night is two horizontal green lights; the clear signal, two vertical green lights, and the danger signal two horizontal lights other than green, red being supposedly used, but a broken glass in a home or distant signal still indicating danger. This means, of course, greater cost of maintenance, two lamps for each main line signal and more complicated mechanism, but gives greater safety and easy reading. It seems to me that the best night signal code is: Red light on high signal; purple light on low signal; white light on any signal and absence of light on any signal all mean danger. Green light means caution, two vertical green lights mean clear. For day signal arrangement I would suggest the following: Home signal as at present; distant signal same shape as at present, but painted yellow with black stripes. Advance signals to consist of disks, and the top arm of the home signal governing the main running route instead of governing to the right, as is the practice on this road and others in the East. This is a most important point which Mr. Gibbs failed to touch upon. I would amend his suggestion in regard to protection of isolated facing point switches by going still further and saying that all isolated switches should be protected, and all facing switches should have some form of distant signal.

In regard to the auxiliary track circuit at interlockings, for preventing change of combination, I would say that the Old Colony R. R. used this device so that as soon as a train had passed the distant signal the route was locked and kept so until the advance was passed, with the result that shifting movements were rather difficult, and the delays at railway grade crossings were numerous.

Mr. Gibbs thinks the Sykes system, with releasing track sections, would be nearly perfect were it not for the practice of permissive blocking. The Hudson Division of the New York Central is the most perfectly-protected piece of track, probably, in the United States. The permissive block is not used, and yet the system is far from perfect. I found that the great danger was the possibility of the forward part of a broken train releasing the plunger and permitting the admission of a second train, with the rear part of the first still in the block, throwing upon the operator the responsibility of determining if the entire train had passed. Another weak point was the issue of clearance cards, made necessary by the large number of signal failures, due to various causes, and making the system at times in reality a permissive block.

I radically differ with Mr. Gibbs as to the great objections to automatic systems (or, at least, to one system). I have at present charge of the Hall signals on the Hartford Division of this road, and can say that, as far as our experience goes, neither of his objections holds good. This system can be installed on a track circuit as cheaply as any manual-controlled, and the liability of its getting out of order is less than with any other system known to me. We have 93 of these signals on this division, most of them operated by track instruments, a few by track circuit, and some by a combination of both. These are maintained by six men, and during the first 15 days of March we have had five failures; two, cause unknown; two, trouble on track circuit; one, broken push button, causing seven trains to stop; showing, I think, that this system is the best yet devised for maintenance and certainty of operation. If any manual-controlled system can give evidence of better work, I would be glad to see it.

The Hall system has, however, two most serious defects. One is the form of its signal, which prevents its being seen far under certain conditions of light and atmosphere (although under other conditions it can be discerned one and a half or two miles away). The other is the feature which is shared by all automatic systems—i. e., its use as a permissive block, the universal practice, as far as I know it, being that a red automatic means two or three minutes' delay and then a cautious advance.

Mr. A. T. Dice (Atl. Cy.).—As to the multiplication of signals being in itself no source of danger, the position taken by Mr. Gibbs is entirely right. In the installation on the New York Central, on the Hudson River Division, we put in 102 signal stations in 130 miles. At all of these were home and distant signals, and at many of them advance signals. Some of the officers feared the condition spoken of; but after the signals were in operation a short time, all were agreed upon the wisdom of having the road properly and fully signaled. Probably six months after they were in operation, one of the best and most intelligent runners on the road said to the superintendent that he would now as soon part with his air-brake as he would with the block signals.

There is to my mind no practical reason why signal indications should not be given during the day by position and at night by color. Should we get the ideal night position signal that so many have been striving for, I do not believe that we would have advanced any. There is undoubtedly a strong feeling in the American Railway Association in favor of red for danger, green for clear, and combination red and green for caution. There is also a strong feeling in the Association in favor of but two indications, red for danger, green for clear, making the light on the distant signal red (the distant signal when used is really the governing signal) and giving trains the right to enter a block already occupied only by order or hand signal, as may be ruled by each road. The reason for advocating but two colors is on account of the lack of a third color that is satisfactory, and not all agreeing on the combination of red and green for caution.

The classification of signals given is more elaborate than is necessary, as signals protecting switches, drawbridges, etc., do often protect the rear end of a train as well, and when necessary to give a danger indication it is perhaps best to give "danger" without attempting to fully convey to the engineman the nature of the danger.

I cannot agree that the automatic is the most modern refinement; at the same time, I believe in it thoroughly. The manual-controlled, as developed in recent installations in America, is undoubtedly the most perfect system yet used. It does not admit of permissive blocking (in fact, I know of no manual controlled systems that do), and in it all switches remote from signal stations are electrically connected and interlocked with the block instrument at the adjacent signal station. The track circuit in the latest manual controlled is really the essential feature, acting as a check upon the signalmen and not allowing them to admit a train to an occupied block, except on written order or hand signal, though both should err and attempt to do so. It is also applicable to single-track working; as, for example, the New York Central between Tonawanda and North Tonawanda, N. Y., operates a block of single track with it over which a large number of trains are passed daily, and with entire success. Generally, however, the cost of the manual-controlled system, in its installation, maintenance and operation, is practically prohibitory, except upon very busy roads, and where a large number of interlockings are necessary.

LEGAL DECISIONS OF INTEREST TO ENGINEERS.

Special Assessments on Unsubdivided Tract.

The only foundation for a local assessment lies in the special benefits conferred upon the property assessed by the improvement, to pay which the assessment is made; and an assessment beyond the benefit so conferred is a taking of property for public use without compensation, and therefore illegal. Under the law relating to cities of the metropolitan class, where an improvement extends through an unsubdivided tract of land, such tract is not subject to local assessment to pay for such improvement to a greater distance from the improvement than the average distance to which assessments on subdivided lots are levied.—Cain v. City of Omaha (Supr. Ct. of Neb.), 60 N. W. Rep., 368.

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PERSONALS.

Mr. J. S. Peter has been elected City Engineer of Corpus Christi, Tex.

Mr. H. M. Redd has been elected City Civil Engineer of Chillicothe, O.

Col. G. W. Hawkins, of the U. S. Geological Survey, has begun a survey of Indian Territory.

Mr. W. W. Read, formerly of the firm of Cooke & Read, Cleveland, O., has been appointed City Engineer of Niagara Falls, N. Y.

Capt. Lauchland McKay, of McKay Bros., shipbuilders, East Boston, Mass., died at Roxbury on April 3, at the age of 83 years.

Mr. F. C. Raff has been appointed General Superintendent of the Indiana, Illinois & Iowa R. R., with headquarters at South Bend, Ind.

Mr. Robert Evans has been elected City Engineer of Haverhill, Mass., vice Mr. John T. Desmond, who had held the office since it was first created.

Mr. David McEntaffer, Superintendent of Roadway and Structures of the Toledo, Ann Arbor and Northern Michigan Ry., recently died at Owosso, Mich.

Mr. Edwin Alonzo Benson has been appointed General Manager of the shops of the Wagner Palace Car Co. at East Buffalo, N. Y., in place of Mr. Thos. A. Bissell, resigned.

Mr. Frank B. Eldred, Superintendent of the Lake Superior Terminal Co., has tendered his resignation, to take effect April 1. He will be succeeded by E. T. Horn, of Macon, Ga.

Mr. Rudolph Hering, M. Am. Soc. C. E., has been employed by the Sewerage Commission of Baltimore, Md., to advise them in regard to the proposed sewerage system for the city and plans for the disposal of the sewage.

Mr. W. G. White has been appointed Engineer of Maintenance of Way on the Erie & Ashtabula Division of the Pennsylvania Lines, with headquarters at Lawrence Junction, Pa., to succeed Mr. H. W. Byers, promoted.

Mr. J. T. McBride has resigned his position as General Manager of the Everett & Monte Cristo Ry., the general offices of which are at Duluth, Minn., to accept a position on the Duluth, Missabe & Northern Ry., in Washington.

Mr. Richard Dudgeon, an inventor and manufacturer, died in New York city on April 8, at the age of 76 years. Mr. Dudgeon was born in Scotland, but came to this country when eight years old. He invented the hydraulic jack 35 years ago, and also the well-known roller expander for boiler tubes.

Mr. H. V. De Hart, C. E., has accepted a position with the King Bridge Co., of Cleveland, O. He has had an extended experience in elevated railway construction, having been engaged on the Brooklyn, the Kings County and the Chicago & South Side Rapid Transit railways, and more recently having been the contractors' engineer in charge on the Lake St. Elevated Ry. construction in Chicago.

Mr. William G. Wilkins, M. Am. Soc. C. E., has been appointed City Engineer of Allegheny, Pa., to succeed Mr. Robert Swan, who resigned to take the position of Supervising Engineer of the new water supply for Allegheny. Mr. Wilkins is a graduate of Rensselaer Polytechnic Institute, and has for eight years been a member of the engineering firm of Wilkins & Davison.

Mr. Frederick C. Bieg, Passed Assistant Engineer, has reported for duty at the Navy Department as assistant to Engineer-in-Chief George W. Melville. He occupied a similar position for several years, until he was attached to the "Miantonomoh," when that vessel went into service in 1891. Mr. Bieg has just returned from a cruise on the "Monterey" and will be promoted to the next rank above his present grade in a few weeks.

Mr. Hyde Clarke, an old and prominent English civil engineer, died in London on March 1. Mr. Clarke was born in London in 1815, and his first engineering experience was of a military character in the War of Succession in Spain and Portugal. In 1836 he was an engineer on the Glasgow & Southwestern Ry., and his work included the famed Morecambe Bay embankment. In 1840 he reported upon the Indian telegraph system, and was later commissioner in England for the Ottoman Empire and for Syria. Mr. Clarke was particularly famous as a linguist, and it is said that he was familiar with a hundred different languges. He was a prolific writer on many subjects, and was vice-president of the Anthropological Institute and the Royal Historical Society.

Mr. Alfred Noble, M. Am. Soc. C. E., who has been appointed by the President one of the members of the Nicaragua Canal Engineering Commission, was born near Detroit, Mich., about 51 years ago, and graduated in 1870 from the University of Michigan. He at once commenced work as a civil engineer on the lakes, and was there, for 12 years, U. S. Assistant Engineer in charge of work on the Sault Ste. Marie Canal. He was later engineer in charge of the building of the Washington bridge across the Harlem, in New York; engineer of the Cairo bridge across the Ohio River, and engineer of the Memphis bridge over the Mississippi River; on both of the latter having as his chief, Mr. George S. Morison, President of the American Society of Civil Engineers. Mr. Noble became a Junior of the Am. Soc. C. E. in 1874, and was made a Member in 1878.

Dr. Thos. M. Drown, Professor of Chemistry in the Massachusetts Institute of Technology, has been elected President of Lehigh University. Dr. Drown took the degree of Doctor of Medicine at the University of Pennsylvania and studied in Germany for some years. He was professor of chemistry for a number of years at Lafayette College, leaving there to go to the Massachusetts Institute of Technology. He was one of the founders of the American Society of Mining Engineers in 1871, and was secretary of that body from February, 1873, to February, 1884. On resigning this position he was made an honorary member of the society. For a number of years past Dr. Drown has been Chemist to the Massachusetts State Board of Health, in which position he has taken a prominent part in the studies made by the board of water and sewage purification and the quality of natural water supplies.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

ENGINEERS' CLUB OF MINNEAPOLIS.
April 15. Secy., E. Nexson, Kasota Block.
WESTERN RAILWAY CLUB.
April 16. Secy., W. D. Crosman, Club Room 9, Grand Pacific Hotel, Chicago.
COLUMBIAN ENGINEERING SOCIETY.
April 16. Secy., W. F. Hart, University Building, 15th and H. Sts. N. W., Washington, D. C.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
April 17. "Bacteria and Other Organisms in Water," by John W. Hill. Secy., C. W. Hunt, 127 E. 23d St., N. Y.
ENGINEERS' CLUB OF ST. LOUIS.
April 17. "Vitrified Brick for Paving," by H. A. Wheeler. Secy., W. H. Bryan, Turner Block.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
April 17. Secy., J. H. Pilcher, Roanoke, Va.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
April 17. Secy., F. Van Vleck, Los Angeles, Cal.
BOSTON SOCIETY OF CIVIL ENGINEERS.
April 17. Secy., S. E. Tinkham, City Hall, Rooms 36 Bromfield St.
AMERICAN RAILWAY ASSOCIATION.
April 17. At Planter's Hotel, St. Louis, Mo. Secy., W. F. Allen, 24 Park Place, New York city.
NEW YORK RAILROAD CLUB.
April 18. Secy., John A. Hill, 256 Broadway, N. Y. City.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
April 18. Secy., D. Carhart, Carnegie Library Building, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
April 18. Secy., J. F. Wilson, Odd Fellows' Temple.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
April 18. Atlanta, Ga., Secy., F. A. Charpiot, Macon, Ga.
ENGINEERS' CLUB OF PHILADELPHIA.
April 20. Secy., L. F. Rondinella, 1122 Girard St.
WISCONSIN POLYTECHNIC SOCIETY.
April 23. Secy., W. K. Means, Loan & Trust Building, Milwaukee.
DENVER SOCIETY OF CIVIL ENGINEERS.
April 23. Secy., H. Breen, 36 Jacobson Block.
CENTRAL RAILWAY CLUB.
April 24. Secy., H. D. Vought, Buffalo "Courier," Buffalo, N. Y.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
April 25. Secy., C. H. McLeod, 12 Mansfield St., Montreal.
INDIANAPOLIS ENGINEERING CLUB.
April 27. Secy., C. C. Brown, City Engineer.
WESTERN SOCIETY OF ENGINEERS.
April 17. "Some Mississippi River Bridges," by Horace E. Horton. Secy., Chas. J. Roney, 1736 Monadnock Block, Chicago.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
May 3. Secy., O. H. Von Gelden, 819 Market St., San Francisco.
ENGINEERING CLUB OF COLUMBUS, O.
May 4. Secy., David Buell.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
May 6. Secy., C. L. Annan, City Engineer's Office.
ENGINEERING SOCIETY OF WESTERN NEW YORK.
May 6. Secy., Geo. R. Sikes, 122 Pearl St., Buffalo, N.Y.
NEW ENGLAND RAILROAD CLUB.
May 8. Secy., F. M. Curtis, P. O. Box 1576, Boston, Mass.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
May 8. Secy., F. R. Hutton, 12 W. 31st St., N. Y. city.
ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
May 9. Secy., James K. Zollinger, Norton Building.
ENGINEERING ASSOCIATION OF THE SOUTH.
May 9. Secy., H. D. Ruhm, Nashville, Tenn.
MONTANA SOCIETY OF CIVIL ENGINEERS.
May 11. Secy., Forrest J. Smith, Denver Block, Helena, Mont.
ENGINEERS' CLUB OF KANSAS CITY.
May 13. Secy., F. W. Tuttle, Baird Building.
NORTHWESTERN SOCIETY OF ENGINEERS.
May 14. Secy., D. W. McMorris, Burke Building, Seattle, Wash.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
May 14. Secy., F. A. Coburn, Case Library Building.
NORTHWESTERN RAILWAY CLUB.
May 14. Secy., W. D. Crosman, Ryan Hotel, St. Paul.
MASTER CAR BUILDERS' ASSOCIATION.
June 11. Annual Convention at Alexandria Bay, N. Y. Secy., J. W. Cloud, Rookery Building, Chicago, Ill.
ASSOCIATION OF RAILWAY TELEGRAPH SUPTS.
June 12. Montreal, Que. Secy., P. W. Drew, Wisconsin Central Ry., Milwaukee, Wis.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
June 14. Secy., D. W. Meeker, St. Paul, Minn.
AMERICAN RAILWAY MASTER MECHANICS' ASSOC'N.
June 17. Annual Convention at Alexandria Bay, N. Y. Secy., Angus Sinclair, 256 Broadway, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At the meeting on April 3 Mr. H. H. Campbell read a paper on "Specifications for Structural Steel," in which, after dealing with the chemical composition and physical requirements of steel, he submitted a schedule of twelve classes of steel (classified according to their grade and the purpose for which each was designed to be used) with specified tests for each class, his contention being that one uniform system of testing cannot apply to steel of all grades and for all purposes.

It was intended that the discussion of this paper and of the final report of the committee on uniform tests of structural material should be taken up together, but as a matter of fact, there was but little discussion. Three or four written communications discussing Mr. Campbell's paper were read, and remarks on the same paper were made at some length by Mr. Gus. Henning and Mr. F. H. Lewis, after which only a few desultory remarks were made, including, of course, reference to the question of the meaning of the terms "standard specifications" and "uniform methods of testing." Considering the importance of the subject, and the varying opinions and experience of the makers and users of steel, it is unfortunate that there was not a more active discussion.

WEST VIRGINIA SOCIETY OF ENGINEERS AND SURVEYORS.—This society was organized on April 4, 1895, at a meeting called for that purpose at the offices of V. A. Dunbar & Son, Parkersburg, W. Va. The following officers were elected: President, W. L. White, Wheeling; Secretary and Treasurer, Wm. Steenberger, Pt. Pleasant (P. O. Gallipolis, O.); Vice-Presidents, J. M. Clark, Kanawha Falls; Chas. E. Krebs, New Martinsville; V. A. Dunbar, Parkersburg. The charter members of the society include, besides the above-named gentlemen, Messrs. J. H. Connor, of Moundsville; S. A. Farrow and J. V. Dunbar, of Parkersburg. Three new members were also elected. Meetings are to be held quarterly, at a time and place to be fixed by the Executive Committee (consisting of the society's officers), and the first annual meeting is to be held at Wheeling on Jan. 8, 1896.

J. V. Dunbar, Secy. pro tem.

ENGINEERING ASSOCIATION OF THE SOUTH.—The regular meeting was held at Nashville on March 28. The secretary read a paper by Mr. Ormsbee describing, as an example of good road building, the road from Hill City, near Chattanooga, to and up Walden's Ridge. To reduce the grade the length of the road was increased three times. The road was constructed by the convicts of the county, under the direction of a competent engineer.

Herman D. Ruhm, Secy.

ENGINEERS' CLUB OF CINCINNATI.—At the February meeting Mr. Geo. W. Passell read a paper on "Wood-Working Machinery." At the meeting in March Mr. G. B. Nicholson read a paper on "Rapid Methods of Making Surveys for Small Scale Maps," which he illustrated by descriptions of surveys made by himself, one of a survey made in 1866 for the location of a wagon road from Lewiston to Virginia City, a distance of about 400 miles, which for the most part was through the Bitter Root Mountains in the northwest part of Idaho. Another survey was of the Mississippi and Missouri rivers, made from the pilot house of a steamboat.

J. F. Wilson, Secy.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—At the meeting on April 1 Mr. Geo. L. Wilson read a brief historical sketch of the Chicago Drainage Canal and described the methods of excavating.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting on April 3 Prof. J. H. Kinealy addressed the club

on the "Different Methods of Determining the Heat Value of Fuels." The three plans in common use are the analytical, Bertier and calorimetric. In the first method the calorific power is computed from the chemical constituents of the fuel, they having first been determined by analysis. This process is open to the criticism that the heat value of pure carbon has been shown to vary as much as 3%, depending upon the condition of the carbon, and this computation also neglects the sulphur. On the whole, however, he considered this plan the best of the three. In the second, or Bertier, method the coal was burned in the presence of litharge, the heat value being assumed to be proportioned to the amount of oxygen absorbed from the litharge. This principle has been shown, however, to be erroneous, but the method nevertheless gives good comparative results. The apparatus used in the third method is usually the Thompson calorimeter, in which the coal is burned in such a way as to give up its heat to a surrounding body of water of known weight, the rise in temperature of which is noted. This method has a considerable error depending upon the temperature of the water used and the heat absorbed by the apparatus itself. Its accuracy depends upon very close reading of thermometers. This method assumes that complete combustion of the coal occurred, which the speaker doubted. This possibility he proposed to investigate further by analyzing the discharged gases.

William H. Bryan, Secy.

NEW PUBLICATIONS.

APRIL MAGAZINES.—In the "North American Review" Admiral P. H. Colomb has a most entertaining discussion of the future of the torpedo in naval warfare. He traces the history of battle-ship and torpedo-boat construction in England and on the Continent during the past fifteen years, and every one interested in naval matters will find in his comments food for profitable thought. Briefly stated, it appears to be the case that while we do not know how the tide of combat will turn when battle-ships and torpedo-boats are pitted against each other in actual warfare, the prospects appear to be that the battle-ship will be absolutely no match for its insignificant adversary. It is already acknowledged that every great battle-ship must have a torpedo vessel as a consort, to protect it from the attacks of the enemy's torpedo vessels, and we are beginning to ask whether these huge floating fortresses, apparently so invulnerable but actually at the mercy of a single well-directed torpedo, are worth what they cost as weapons of offense or defense. In short, without saying it in so many words, the gallant Admiral hints that boats like the "Havock," the "Hornet" and the "Daring" are so much superior to the huge battle-ships, costing twenty times as much, that the latter might as well be laid on the shelf. Mr. Geo. U. Crocker discusses the question: "Does Fire Insurance Cost Too Much?" He points out that whereas the annual fire losses of the United States amount to $150,000,000, the total cost of fire insurance, including these losses is about $300,000,000. He holds that the excessive commissions paid to insurance brokers are chiefly to blame for the excessive cost of fire insurance, and that a reform is certain to come in the near future. When we reflect that the average return on interest-paying investments is now barely 5%, and that the average insurance rates in the United States are estimated at 1%, the economic importance of a reduction in the fire risk and of the tax paid to insurance companies for distributing the fire losses is apparent. Mr. T. A. Rickard, M. Inst. M. E., writes on "The Conditions of Gold Production," replying to the optimistic paper by the Director of the Mint in the same magazine for January. Mr. Rickard is a metallurgist and mining engineer of experience, and he presents strong arguments to show that the present increased production of gold is but a temporary thing, and that a marked falling off is inevitable with the exhaustion of the shallow placers and the extension of geographical exploration over all the world's area. Hon. L. A. Thurston has an excellent article on "The Growing Greatness of the Pacific," which he opens by quoting from a speech by Wm. A. Seward in 1852: "The Pacific Ocean, its shores, its islands and the vast region beyond will become the chief theatre of events in the world's great hereafter."

In "The Forum" Edward Atkinson discusses "The Battle of Standards and the Fall of Prices." Henry J. Fletcher discusses 'The Decline of the Small Town." He describes very well the change by which the industries of the small villages have succumbed to competition, but, with curious blindness, lays chief blame on the railways and the Interstate Commerce Law, whereas the change from the local manufactory in the small country village to the great "works" located at the most advantageous manufacturing center is merely a case of survival of the fittest, for which the railways are as little to be blamed or praised as they are for the movements of the planets.

In the "Popular Science Monthly" we find a weak and silly paper by Appleton Morgan, with the inappropriate title "The Successor of the Railway." The "Electric Railway," according to Mr. Morgan, is to be the successor of the railway. It apparently never has occurred to him that the electric railway is a railway. The article contains such glaring misstatements of facts that it can hardly mislead our readers, but it is calculated to do much harm in influencing investors to place undue confidence in the numerous wildcat electric railway schemes which are seeking public support nowadays. The "Popular Science Monthly" deserves censure for printing such unscientific trash. Another paper in the same magazine, which deserves a word of notice here is Dr. C. Hanford Henderson's second article on "Manual Training." The writer has a tendency to indulge too much in finespun theories, however, to make his paper especially valuable. In "The Review of Reviews" Dr. Albert Shaw writes on "Our Civic Renaissance," describing the movement for reform in municipal governments which has been such a marked feature of the past two years. "Scribner's" and "Harper's" this month contain little of especial interest to the engineer; but the "Century" gives just prominence to a paper by Mr. T. Commerford Martin on "Tesla's Oscillator and Other Inventions." Mr. Martin is, however, disappointingly vague as to just what the practical advantages of Mr. Tesla's oscillator really are. Glittering generalities are all he gives us, and he himself "doubts whether the inventor has yet been able to sit down and sum up all the realities and possibilities to which it is a key." Whatever the advantages of the oscillator may be in compactness, it is a well-known fact that the best existing steam engines and dynamos when running on a steady load have their chief waste in their inefficient use of steam rather than by friction in the engine and electrical loss in the dynamo, and it is apparently only this friction and electrical loss which the oscillator is designed to save.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Apr. 12.	Breakwater, Davids Island, N. Y. H.		Mar. 21
Apr. 12.	Brick paving, Springfield, O.		Mar. 21
Apr. 12.	Steel bridge (220 ft.), Ogdensburg, N.Y. Advertised, Eng. News, Mar. 28.		Mar. 28
Apr. 12.	Brick jail, King George, Va.		Mar. 28
Apr. 12.	Public building at Salina, Kan.		Mar. 28
Apr. 12.	Chemical engines (2), Boston, Mass.		Apr. 4
Apr. 12.	Lumber at Fort Delaware, Philadelphia. Advertised, Eng. News, Apr. 4.		Apr. 4
Apr. 12.	Asphalt paving, etc., Omaha, Neb.		Apr. 4
Apr. 12.	Culverts, Washington, D. C.		Apr. 4
Apr. 12.	Water-works materials, Ballard, Wash.		Apr. 11
Apr. 13.	Road improvement bonds, Athens, O.		Mar. 21
Apr. 13.	Electric lighting, Stratford, Ont.		Mar. 28
Apr. 13.	Public bldg. work at St. Paul, Minn.		Apr. 4
Apr. 13.	Sewers, Melrose, Mass.		Apr. 11
Apr. 13.	Macadamizing, Weehawken, N. J.		Apr. 11
Apr. 13.	Sidewalks, Sandusky, O.		Apr. 11
Apr. 13.	Sewer pipe (54,000 ft.), Winthrop, Mass.		Apr. 11
Apr. 15.	Sewer bonds South Orange, N. J.		Mar. 14
May 15.	Plans, etc., for bridge, Montreal Advertised, Eng. News, Jan. 24 and 31.		Jan. 24
Apr. 15.	Water-works system, Westville, N. S.		Mar. 21
Apr. 15.	Dams & shore protec., Rock Isl., Ill. Advertised, Eng. News, Mar. 21 to Apr. 11.		Mar. 21
Apr. 15.	Paving dikes, New York, N. Y.		Mar. 21
Apr. 15.	Water power plant, West Troy, N. Y.		Mar. 21
Apr. 15.	Dredging, Portland, Me. Advertised, Eng. News, Mar. 21 to Apr. 11.		Mar. 21
Apr. 15.	Iron towers, Detroit, Mich. Advertised, Eng. News, Mar. 28 and Apr. 4.		Mar. 28
Apr. 15.	Pipe sewers, Waukegan, Ill.		Mar. 28
Apr. 15.	Filling, etc., San Francisco, Cal.		Mar. 28
Apr. 15.	Water-works system, Norman, Okla.		Apr. 4
Apr. 15.	Sewer, Brooklyn, N. Y.		Apr. 4
Apr. 15.	Court-house bonds, St. James, Minn.		Apr. 4
Apr. 15.	Court-house plans, St. James, Minn.		Apr. 4
Apr. 15.	Electric lighting, Atlantic City, N. J.		Apr. 11
Apr. 15.	Brick walks, etc., Somerset, Ky. Advertised, Eng. News, Apr. 11.		Apr. 11
Apr. 15.	Brick sewers, Toledo, O.		Apr. 11
Apr. 15.	Jail, Chicago, Ill.		Apr. 11
Apr. 15.	Street sweeping, Milwaukee, Wis.		Apr. 11
Apr. 15.	Water-works const'n, Ballard, Wash.		Apr. 11
Apr. 15.	Laying water pipe, New Orleans, La.		Apr. 11
Apr. 16.	Stone dikes, Cincinnati, O. Advertised, Eng. News, Mar. 21 to Apr. 11.		Mar. 21
Apr. 16.	Viaduct substructure, Cincinnati, O. Advertised, Eng. News, Mar. 28 and Apr. 4.		Mar. 28
Apr. 16.	Viaduct superstructure, Cincinnati, O. Advertised, Eng. News, Mar. 28 and Apr. 4.		Mar. 28
Apr. 16.	Bridges, Auburn, Ind.		Mar. 28
Apr. 16.	Pumping engine, Oil City, Pa.		Apr. 4
Apr. 16.	Sewers, New York, N. Y.		Apr. 4
Apr. 16.	Pipe sewer, Buffalo, N. Y.		Apr. 4
Apr. 16.	Earth dam, Waterbury, Conn. Advertised, Eng. News, Apr. 4.		Apr. 4
Apr. 16.	Brick sewer, Buffalo, N. Y.		Apr. 4
Apr. 16.	Ext'n of college bldgs., Halifax, N. S.		Apr. 4
Apr. 16.	Asphalt paving, New York		Apr. 4
Apr. 16.	Granite blocks, Brooklyn, N. Y.		Apr. 11
Apr. 16.	Physical laboratory, Philadelphia, Pa.		Apr. 11
Apr. 16.	Naval supplies, Washington, D. C.		Apr. 11
Apr. 16.	Removing & re-erecting bridge, Denver.		Apr. 11
Apr. 16.	Macadamizing, Morristown, N. J.		Apr. 11
Apr. 17.	Sewers (27 miles), Champaign, Ill. Advertised, Eng News, Mar. 7 to Apr. 5.		Mar. 14
Apr. 17.	Dredging, Cleveland, O.		Mar. 28
Apr. 17.	Electric light plant, Willoughby, O.		Mar. 28
Apr. 17.	Bridge, Providence, R. I. Advertised, Eng. News, Apr. 4 and 11.		Apr. 4
Apr. 17.	Sewers, New York, N. Y.		Apr. 11
Apr. 17.	Paving, etc., New York, N. Y.		Apr. 11
Apr. 17.	Boilers, etc., Newark, N. J.		Apr. 11
Apr. 17.	Warehouse, Philadelphia, Pa.		Apr. 11
Apr. 17.	Electric lighting, Chicago, Ill.		Apr. 11
Apr. 17.	Street improvements, Chicago, Ill.		Apr. 11
Apr. 18.	License to cut timber, Toronto, Ont.		Mar. 21
Apr. 18.	Paving, Warren, O.		Mar. 28
Apr. 18.	Stone paving, Cincinnati, O.		Mar. 28
Apr. 18.	Water-works system, Digby, N. S.		Mar. 28
Apr. 18.	Pipe sewers, Williamsport, Pa. Advertised, Eng. News, Apr. 4 and 11.		Apr. 4
Apr. 18.	Dredging, San Francisco, Cal.		Apr. 4
Apr. 18.	Sewer system, Hastings-on-Hudson. Advertised, Eng. News, Apr. 4 and 11.		Apr. 4
Apr. 18.	Temporary court house, Baltimore.		Apr. 4
Apr. 18.	Public bldg. work at Kansas City, Mo.		Apr. 4
Apr. 18.	Paving, Buffalo, N. Y.		Apr. 11
Apr. 19.	Water-works system at Ft. Shaw, Mont.		Apr. 4
Apr. 19.	Pine lumber, St. Louis, Mo.		Apr. 4
Apr. 19.	Sewer system, Fort Shaw, Mont.		Apr. 4
Apr. 19.	Asphalt paving, Washington, D. C.		Apr. 11
Apr. 19.	School house, North Evans, N. Y.		Apr. 11
Apr. 20.	Bridge bonds ($39,000), Glendive, Mont.		Apr. 4
Apr. 20.	Road, Boston, Mass.		Apr. 11
Apr. 20.	Driven wells, Norfolk, Va. Advertised, Eng. News, Apr. 11.		Apr. 11
Apr. 20.	Brick paving, Wheeling, W. Va.		Apr. 11
Apr. 20.	Bridge, Rome, Ga.		Apr. 11
Apr. 20.	Brick paving, Benwood, W. Va.		Apr. 11
Apr. 20.	Water meters, Washington, D. C. Advertised, Eng. News, Apr. 11.		Apr. 11
Apr. 22.	Elec.light bonds ($12,000), Elberton, Ga.		Mar. 28
Apr. 22.	Pumping engine, Homestead, Pa. Advertised, Eng. News, Apr. 4 to 18.		Apr. 4
Apr. 22.	Water-works supplies, Cincinnati, O.		Apr. 4
Apr. 22.	Bridge, Kenton, O.		Apr. 4
Apr. 22.	Paving, Medina, O.		Apr. 4
Apr. 22.	Iron bridge, Binghamton, N. Y. Advertised, Eng. News, April 11 and 18.		Apr. 11
Apr. 22.	Army buildings, Davids Island, N. Y.		Apr. 11
Apr. 22.	Bank building, Galveston, Tex.		Apr. 11
Apr. 22.	Street railway (3 miles), McKeesport, Pa.		Apr. 11
Apr. 22.	Paving materials, Baltimore, Md.		Apr. 11
Apr. 22.	Electric lighting, Holyoke, Mass.		Apr. 11
Apr. 22.	Paving, Brooklyn, N. Y.		Apr. 11
Apr. 23.	Hospital bldg. at Ship Island, Miss.		Apr. 4
Apr. 23.	Grading, Helena, Mont.		Apr. 4
Apr. 23.	Trenching, etc., Buffalo, N. Y.		Apr. 11
Apr. 23.	Bridge, Buffalo, N. Y.		Apr. 11
Apr. 23.	Earth excavation, etc., Boston, Mass.		Apr. 11
Apr. 24.	Buildings, San Marcos, Tex. Advertised, Eng. News, Mar. 28 to Apr. 11.		Mar. 28
Apr. 25.	Water-works, West Troy, N. Y.		Mar. 28
Apr. 25.	Sewers (18 miles), Manchester, Va. Advertised, Eng. News, Apr. 4 and 11.		Apr. 4
Apr. 25.	Sewer materials, Manchester, Va. Advertised, Eng. News, Apr. 4 and 11.		Apr. 4
Apr. 25.	Stone road, Helena, Mont.		Apr. 4
Apr. 25.	60-in. intake conduit, Erie, Pa. Advertised, Eng. News, Apr. 4 and 11.		Apr. 4
Apr. 25.	Bridge, Gainesville, Ga.		Apr. 4
Apr. 25.	Lumber and hardware, Winnipeg, Man.		Apr. 11
Apr. 26.	Electric lighting, Greensboro, N. C.		Apr. 4
Apr. 26.	Officers' quarters, Helena, Mont.		Apr. 11
Apr. 30.	Jail, Dawson, Ga.		Mar. 28
Apr. 29.	Paving, Montgomery, Ala.		Apr. 4
Apr. 29.	Dredging, Wilmington, Del.		Apr. 4
Apr. 29.	Roads, Detroit, Mich.		Apr. 11
Apr. 30.	Keeping Mobile River clear of timber.		Apr. 4
Apr. 30.	Cement, stone, etc., Mobile, Ala. Advertised, Eng. News, Apr. 4 to 25.		Apr. 4
Apr. 30.	Street improv't bonds, Mt. Pleasant, O.		Apr. 4
Apr. 30.	Sea wall, Baltimore, Md.		Apr. 11
Apr. 30.	Post office building at Rimouski, Que.		Apr. 11
Apr. 30.	Cement (25,000 lbs.), Ottawa, Ont.		Apr. 11
May 1.	Sewer system, Sudbury, Ont.		Mar. 28
May 1.	Water-works system, Sudbury, Ont.		Mar. 28
May 1.	Buildings, New Orleans, La. Advertised, Eng. News, Mar. 28 to Apr. 18.		Mar. 28
May 1.	Metalwork, New Orleans, La. Advertised, Eng. News, Mar. 28 to Apr. 18.		Mar. 28
May 1.	Water bonds ($10,000), Cascade, Ia.		Apr. 4
May 1.	Stone and asphalt paving, Cleveland.		Apr. 4
May 1.	Dredging, Oswego, N. Y.		Apr. 11
May 1.	Post office building, Bloomington, Ill.		Apr. 11
May 1.	Brick paving, Peoria, Ill. Advertised, Eng. News, Apr. 11 to 25.		Apr. 11
May 1.	Sewers (20 miles), Williamsbridge, N. Y. Advertised, Eng. News, Apr. 11 to 25.		Apr. 11
May 1.	Drill hall, Plattsburg, N. Y.		Apr. 11
May 3.	Brick sewers, Richmond, Ind.		Apr. 11
May 3.	Pipe sewers, Richmond, Ind.		Apr. 11
May 4.	Roads (7½ miles), Vevay, Ind.		Apr. 4
May 6.	Bridges, Los Angeles, Cal.		Apr. 11
May 6.	Sewers, Cincinnati, O.		Apr. 11
May 6.	Paving, Cincinnati, O.		Apr. 11
May 7.	Paving, Terre Haute, Ind.		Apr. 11
May 9.	Pumping engines, Brooklyn, N. Y. Advertised, Eng. News, Apr. 11.		Apr. 11
May 10.	Bridge, Plymouth, Ind.		Apr. 11
May 13.	Plans for court house, Liberty, Tex.		Apr. 11
May 15.	Smokeless powder, Washington, D. C.		Apr. 4
May 15.	Bridge, Glendive, Mont.		Apr. 4
May 15.	Memorial hall, West Point, N. Y. Advertised, Eng. News, Apr. 11 to May 2.		Apr. 11
May 20.	Water bonds, Santa Clara, Cal. Advertised, Eng. News, Mar. 7 to 28.		Mar. 7
May 20.	Court-house, Wrightsville, Ga.		Apr. 4
May 23.	Water-wks. system, Santa Clara, Cal. Advertised, Eng. News, Mar. 7 to 28.		Mar. 7
Oct. 1.	Plans for art building, Philadelphia, Pa.		Apr. 11
No date.	Electric light plant, Cascade, Ia.		Apr. 4
"	Plans for court house, Sparta, Tenn.		Apr. 11
"	Hospital building, Parris, Cal.		Apr. 11
"	Chemical engine, etc., Montrose, S. D.		Apr. 11
"	Cast iron pipe, etc., Salem, S. Dak.		Apr. 11

RAILWAYS.

East of Chicago.

BRIDGEPORT.—Incoporated in Pennsylvania April 8 to build a steam railway from Swedes Church, in Upper Marion township, Montgomery county, Pa., to Heisher furnace; capital stock, $15,000; Pres., Daniel B. Shepp, Philadelphia, Pa.

CHICAGO, INDIANA & EASTERN.—Press reports state that tracklaying will be commenced this week on this road, between Muncie and Fairmount, Ind., 26½ miles. The contract for the construction was awarded nearly two years ago, but the construction was discontinued after considerable grading had been done. The Illinois Trust & Savings Bank is reported as advancing $15,000 a mile for the construction. The

officers in 1893 were as follows: Pres., F. A. Root; Secy., W. M. Nichols; Ch. Engr., D. G. Seymour; principal office at Fairmount, Ind.

CHICAGO, UNION CITY & CINCINNATI.—It is reported that the construction of this railway between Union City and Bluffton, Ind., 60 miles, has been abandoned, and that the contractors have removed their outfits to the Chicago, Indiana & Eastern. The contract for building the road was awarded to J. J. Shafer, of Chicago, about a year ago. Pres., J. C. Fawcett, Louisville, Ky.; Secy., G. W. Patchell, Union City, Ind.

CONSHOHOCKEN CONNECTING.—Incorporated in Pennsylvania April 8, to build a steam railway from Black Horse three-fourths of a mile to the Conshohocken R. R., in Montgomery county; capital stock, $10,000; Pres., Daniel B. Shepp, Philadelphia, Pa.

NEW YORK CENTRAL & HUDSON RIVER.—Bids were opened April 3 for the city's share of the work in abolishing the grade crossings at Buffalo, N. Y. The bidders were all Buffalo men, as follows: James Stewart & Co., $74,265; Christopher Smith, $87,649; B. J. Crooker, $62,595; George W. Moore, $63,750; Dwyer & McNaughton, $59,825. Dwyer & McNaughton's bid was within $1,800 of the estimated cost, and they will get the contract.

PITTSBURG CONNECTING.—Incorporated in Pennsylvania April 3 to construct a steam railway from 300 ft. east of Hawkins Station, on the Pennsylvania, southerly to the Monongahela River; capital stock, $200,000; Pres., Frank L. Slocum, Pittsburg, Pa.

PITTSBURG & EASTERN.—This company was incorporated a year ago to build a railway about 20 miles in length from Crab Tree, Westmoreland county, to White, Indiana county, Pa., connecting two lines of the Pennsylvania road. Press reports state that the road is now projected from Mahaffey to West Newton, 115 miles, with a number of coal branches, and that the first 20 miles will probably be placed under contract as soon as the specifications are completed, and the construction commenced within 60 days. The work will include three bridges over the Susquehanna River, each over 300 ft. in length. Surveys for the road were completed in October, and since then the line has been revised and the right of way nearly all secured. Pres., C. C. Watt; Gen. Man., S. H. Hicks; Secy. and Treas., L. V. Biggs; Ch. Engr., J. C. Patterson; general office, Bullitt Building, Philadelphia.

UNION.—W. H. Smith, Ch. Engr., writes us that this railway is in the hands of the Carnegie Steel Co., Homestead, Pa., and will be completed some time within two years. It is a private road.

Southern.

CHESAPEAKE, SHENDUN & WESTERN.—This projected railway was noted in our issue of March 14. It is stated that E. C. Machen, Pres. Old Dominion Construction Co., 1 Broadway, New York, is arranging to commence the construction at an early date at Harrisonburg, Va. The road would open up large tracts of timber and coal lands in Rockingham county, Va., and in West Virginia.

SELMER & TENNESSEE RIVER.—The construction of this railway was to have been commenced April 8. The line will traverse the Shiloh battlefield and be 20 miles in length. Geo. H. Bunch, Purchasing Agt., Memphis, Tenn., is in the market for a 35-ton mogul freight locomotive, a 30-ton passenger locomotive, several cars, and 1,500 tons of 56-lb. steel rails, etc., for which cash will be paid.

Northwest.

CALUMET & BLUE ISLAND.—An extension 10 miles long is to be made from South Chicago to Clark Junction, Ind. Surveys are now being made. Ch. Engr., C. E. Dearborn, South Chicago, Ill.

CHICAGO GREAT WESTERN.—In regard to the reported reconstruction of 100 bridges and culverts, Olaf Hoff, Consult. Engr., Minneapolis, writes us that the contract for stone culverts has been awarded to T. Houston, of Minneapolis. There are no bridges to be built.

CHICAGO, SUPERIOR & PACIFIC.—This company was incorporated March 17, 1894, as a revival of the old Wisconsin Air Line project, on which nearly 185 miles had been graded and bridged in 1873. Wm. R. Chadsey, of New York, the chief projector, is reported to have interested foreign capitalists, who will soon inspect the line with a view to resuming the construction.

DEKALB & GREAT WESTERN.—The incorporation of this company was noted in our issue of March 28. It is stated that the contract for the grading and tracklaying has been awarded to Foley Bros. & Guthrie, of St. Paul, and that the road will be built without bonded indebtedness. The line will extend from Sycamore, on the Chicago Great Western, 52 miles west of Chicago, to DeKalb, Ill., on the Chicago & Northwestern, a distance of six miles. Pres. and Ch. Engr., Raymond Du Puy, Temple Bldg., Chicago.

DULUTH & NORTH DAKOTA.—D. W. Hines, Pres., is reported to have awarded contracts, at 7 cts. per cu. yd., for grading this railway between Drayton and St. Thomas, N. Dak., 27 miles. The company is composed mostly of farmers who are trying to build a railway to take their crops to market. The project was noted in our issue of Feb. 7.

GREAT NORTHERN.—A press report states that J. J. Hill., Pres., has contracted with Foley Bros. to grade a line from Sandstone, Minn., on the Eastern Minnesota, west to Milaca Lake, work to begin at once.

MERRILL, ANTIGO & EASTERN.—We are informed that this railway, noted last week, will pass through Prentice, Knox, Merrill and Antigo, Wis., and will be about 100 miles in length, of which it is intended to build about 80 miles this year. No contracts have yet been awarded, but the construction is expected to be commenced within four or five weeks. The location survey is being made as rapidly as possible. Ch. Engr., Thos. R. Hasley (Ch. Engr. Wisconsin & Michigan Ry., Menominee, Mich.), present address, Merrill, Wis.; Asst. Engr., R. C. Gowen, Wausau, Wis.; Pres., S. Heineman, Merrill, Wis.

Southwest.

EXCELSIOR SPRINGS.—It is reported that this railway will be extended five miles to Lawson. Pres. and Gen. Man., S. F. Scott, Excelsior Springs, Mo.

LINK LINE.—A correspondent writes us as follows in regard to the contracts recently awarded for the construction of this railway, noted in our issue of March 14: The contract for grading, trestle, bridging and tracklaying was awarded to Ware, MacNamara & Co., composed of J. A. Ware, of St. Louis; J. S. MacNamara, of San Antonio, and E. S. Johnson, of Flint & Johnson Construction Co., of Davenport, Ia. This contract is for the line from Granger, Tex., to Trinity, Tex., a distance of 131 miles, and all branches as shown in the articles of incorporation of the company (except 15 miles from Georgetown to Granger), a total of about 200 miles. The work is to be completed from Granger to Trinity by July 15, 1896. Locomotives and steel rails are expected daily, and tracklaying will begin at once on the line from Granger to Georgetown, the grading of which is already completed. Subcontracts will be let about April 20 on line from Granger to Trinity.

MISSOURI PACIFIC.—A press report from Lebanon, Mo., states that Jacob Blickensdorffer, a well-known engineer, will soon go over the route for a proposed extension of this railway to that city from Bagnell.

MUSCOGEE, OKLAHOMA & WESTERN.—Incorporated in Oklahoma April 1 to build a railway from Muscogee, Ind. T., to Enid, Okla., a distance of 200 miles, passing through Cleveland, Pawnee and Perry, Okla. The work of the preliminary survey and securing the right of way will begin at once and be pushed as rapidly as possible; capital stock, $1,000,000; Pres., G. W. Sutton; 1st Vice-Pres., Col. J. L. Morphis; 2d Vice-Pres., Col. John W. Jordan; Secy., Judge B. W. Morphis; Treas., W. H. Herbert; Gen. Attorney, Judge A. H. Boles.

ORANGE TERMINAL.—Incorporated in Texas April 5, with a capital stock of $100,000, by H. J. Lutcher, Alex. Gilmer, Dennie Call, W. H. Stark, W. W. Reed, C. A. Teagle, L. Miller, L. Larson and J. H. Dawson.

THURBER & LLANO.—It is reported that contracts will soon be awarded for building a railway between Thurber and Llano, Tex. About 26 miles of the right of way has been secured. Address Henry N. Smith, Stephenville, Tex.

VINING & COLEMAN.—A correspondent writes us that surveys have been completed and the right of way secured for this railway, which is projected from Overalls Junction, on the Gulf, Colorado & Santa Fe, southerly to the town of Vining, 20 miles, all in Coleman county, Tex. No contracts have yet been awarded, though it is expected that the construction will be commenced within 30 days after authority has been granted to issue bonds. Press reports state that the state railway commission, on April 1, granted the company authority to issue $13,500 of bonds per mile for 20 miles of road; Pres., W. L. Vining; Ch. Engr., Jno. W. Maxey, both of Austin, Tex.

Rocky Mt. and Pacific.

COLUMBIA RIVER & ASTORIA.—Andrew B. Hammond, of Missoula, Mont., and J. C. Stanton, Auditorium Hotel, Chicago, who contracted some time ago to build this railway from Astoria to Goble, Ore., 60 miles, are now at Astoria arranging to commence the work, according to press reports. This railway has been projected for many years and reports have stated several times that the construction would soon be commenced.

LOS ANGELES & SANTA MONICA.—Incorporated in California April 4 to build a railway between Los Angeles and Santa Monica, Cal.; capital stock, $500,000, commencing with $50,000; incorporators, C. B. Van Every, V. H. Raleigh, J. J. O'Brien, A. W. Eames and Jas. P. Montgomery, all of Los Angeles, Cal.

WHITE RIVER VALLEY.—The incorporation of this company was noted in our issue of March 21. F. E. Sheridan, Meeker, Colo., writes us that it was expected to commence surveys for the line between New Castle and Meeker, 50 miles, April 8. The right of way has all been donated and capital for the construction secured. The contracts will be awarded within 30 days, and grading commenced within six weeks. Pres., A. C. Drumm, Denver, Colo.; Ch. Engr., A. L. Drake, La Junta, Colo.

STREET AND ELECTRIC RAILWAYS.

NASHUA, N. H.—It is reported that the Nashua St. Ry. Co. will commence the construction of an extension of its road from Hudson to Lowell as soon as the ground permits. The entire road will be equipped with electricity. Supt., H. F. Webster.

FALL RIVER, MASS.—The Globe St. Ry. Co. has petitioned for a franchise on several streets. Treas., Robt. S. Goff.

NEWTON, MASS.—The Commonwealth Ave. St. Ry. Co. has petitioned for a franchise for a railway on the new boulevard from Washington St., West Newton, to the Boston city limits.——The Wellesley & Boston St. Ry. Co. is reported as to build an electric road from Newton Lower Falls to West Newton and Wellesley.

TURNER'S FALLS, MASS.—The Turner's Falls, Lake Pleasant & Miller's Falls St. Ry. Co. has been incorporated, with a capital stock of $50,000, to build an electric road five miles in length. Clk. and Treas., Chas. E. Dresser; directors, H. S. Pierce, of Leominister; Charles Barnes, of Plymouth, and N. S. Cutler, of Greenfield.

VINEYARD HAVEN, MASS.—The Vineyard Haven St. Ry. Co. has been organized, and will soon petition for a franchise. Pres., Francis J. Hartshorn, of Newtonville; Treas., Geo. A. Beatey, of Hyde Park; directors, Kemp Clark, of Quincy; W. M. Randall and C. P. West, of Vineyard.

WORCESTER, MASS.—It is reported that the North End. St. Ry. Co. is again considering the question of extending its electric road to Barber's Crossing. It is proposed also to build a power house at Barber's Crossing. Supt., Chas. L. West.

CORNING, N. Y.—The Corning & Painted Post Electric Ry. Co. has awarded the contract for its entire power plant to B. W. Payne & Sons, of Elmira. The plant will consist of five 100-HP. compound condensing engines, three boilers of 500 HP., etc.

FLUSHING, N. Y.—The Flushing & College Point Electric Ry. has been sold to Cravath & Houston for $25,000. The road is about six miles in length, and is said to have cost $125,000. It is reported that the purchasers will expend $50,000 in extending the road and improving the rolling stock.

KINGSTON, N. Y.—The Rondout & Eddyville Ry. Co. has been incorporated to build a road from this city to Eddyville, a distance of three miles; capital stock, $30,000; Wm. T. Hiscox and Fred. C. Beach, of New York; Joseph V. Wilson, of Brooklyn; Albert Terry, of Kingston, and John M. Cordts, of Rondout.

JERSEY CITY, N. J.—J. H. Symes is circulating a petition for permission to construct an electric railway from Homestead, North Bergen, to Main St., Union Hill.

NEWARK, N. J.—Bird W. Spencer and Thos. M. Moore, of the Passaic & Newark Electric R. R. Co., and R. W. Booth, Chn. Franklin township committee, have petitioned for permission to build an electric railway between Newark and Paterson.

RED BANK, N. J.—The Atlantic Highlands, Red Bank & Long Branch Electric Ry. Co. has been incorporated, with a capital stock of $500,000, $25,000 of which is paid in; incorporators, David S. Arnott, Silas B. Dutcher, Wm. H. Hazard, of Brooklyn, N. Y.; A. J. Allen, of Hoboken, and Wm. T. Parker, of Little Silver, N. J.

DUQUESNE, PA.—The Monongahela Traction Co. has been organized to build an electric railway. Alan D. Wood, John F. Davitt, L. G. Woods and J. H. Adams are interested.

McKEESPORT, PA.—The Shenango Valley Electric St. Ry. Co. has been reorganized and will probably improve its road between Sharon and Sharpsville. Pres., A. M. Jolly; Secy., A. R. Leyda; Treas., F. G. Barker; Supt., F. G. Runser.

McKEESPORT, PA.—Bids are asked by the McKeesport, Duquesne & Wilmerding Ry. Co. until April 22 for constructing about three miles of its electric road and furnishing all material. Man., James L. Devinny, First National Bank Bldg.

MEDIA, PA.—A correspondent writes us that the contract for the extension of the Delaware County & Philadelphia Electric Ry. from its present terminus at Washington St. and Providence Ave. to Washington St. and South Ave., in the heart of the town, a distance of a half mile, has been awarded to Johnson & Wickersham, of Media.

PHILADELPHIA, PA.—The plans of the Fairmount Park & Heddington Ry. Co. for its road on a number of streets has been approved.——The Union Passenger Ry. Co. has applied for a franchise on several streets.

PITTSBURG, PA.—The Allegheny & South Side Ry. Co. has been organized to build an electric freight railway on Bingham St., to connect with the various mills owned by the Oliver & Roberts Wire Co.

SCRANTON, PA.—The Scranton Traction Co. has been granted permission to extend its road on Franklin Ave.

STROUDSBURG, PA.—A receivers' sale of the Delaware Valley Electric Ry. and the East Stroudsburg & Matamoras R. R. is ordered at Stroudsburg, Pa., April 22. The road is designed to reach the dairy region of northwestern New Jersey, and the famous waterfalls of Pike county, Pa., and is projected to run from the D., L. & W. R. R. at Stroudsburg, Pa., to the N. Y., L. E. & W. R. R. at Port Jervis, N. Y., via Bushkill and the Delaware valley, a distance of 40 miles. Twenty miles have been located, and eight graded. Receivers, Frank Coolbaugh, Edwin F. Peters; Ch. Engr., A. Frank Carrick, Stroudsburg, Pa.

WILKES BARRE, PA.—It is reported that the Wilkes Barre & Wyoming Valley Traction Co. has authorized an issue of $350,000 in bonds, a portion of which is for building the extensions over Brewery Hill. Gen. Man., J. Graham.

WILLIAMSPORT, PA.—The Muncy Valley St. Ry. Co. has been incorporated to build an electric road from Muncy to Picture Rocks, by way of Muncy Creek and Hughesville; capital stock, $50,000, with $15,000 paid in. Pres., H. J. Cluger.

PARKERSBURG, W. VA.—V. A. Dunbar & Son, of this city, were to begin surveys April 9 for extending the Park City St. Ry. and for changing it from horse to electric power.

BRUNSWICK, GA.—W. A. Jeter, of Macon, has petitioned the council for a franchise for an electric railway.

CHATTANOOGA, TENN.—The St. Elmo & Lookout Mountain Ry. Co. has applied for a charter to build a cable road to the summit of Lookout Mountain, a distance of 4,600 ft.; capital stock, $100,000; Man., Wm. H. Steere, of Chattanooga and Boston; Engr., Thos. E. Brown, Jr., 38 Park Row, New York. A. D. Storey and E. Watkins, of this city, are interested. It is stated that the road will be built by the Otis Elevator Co., of New York.——The construction of a cable road, estimated to cost $75,000, to the top of Lookout Mountain is also being considered by M. M. Henderson and others, according to reports.

NASHVILLE, TENN.—The Memphis St. Ry. Co. has been incorporated by F. G. Jones, T. B. Turley, John K. Speed and M. B. Mallory.

PADUCAH, KY.—The Citizens' St. Ry. Co. is to be reorganized, and will extend its electric road and make a number of improvements. John W. Keller, Frank Fisher and W. F. Paxton are interested.

CLEVELAND, O.—Henry A. Everett has petitioned the Cuyahoga county commissioners for a 25-year franchise for an electric road from this city to Painesville, estimated to cost about $350,000. Frank E. Dellenbaugh is interested.

DETROIT, MICH.—S. Hendrie, Ch. Engr., Newberry Bldg., writes us that it is intended to open the Oakland Ry. Co.'s electric railway between Royal Oak, Birmingham and Pontiac, a distance of 18 miles, this summer. Pres., George Hendrie.

KALAMAZOO, MICH.—The residents of the east side are reported as about to make a proposition to the Citizens' St. Ry. Co. for an extension of its road to that portion of the city.

CHICAGO, ILL.—The Baird Electric Conduit Co. has been incorporated to build an electric conduit railway on Indiana Ave. and Clark St.; capital stock, $5,000,000; incorporators, F. E. Baird, G. E. Baird and W. H. Craig.——The Chicago Subway Arcade & Traction Co. has been incorporated to build subway rail-

ways; capital stock, $1,500,000; incorporators, C. F. Griffin, M. E. Barnhart and J. F. Nelson.

PEORIA, ILL.—The Richwood St. Ry. Co. has been incorporated to build a road through Peoria, Tazewell and Woodford counties; capital stock, $50,000; incorporators, Robt. M. Cox, James M. Morse and Theodore J. Miller.

HOUSTON, TEX.—The Houston Rapid Transit Co. has petitioned for authority to extend its road on a number of streets.

NIAGARA FALLS, ONT.—The Toronto, Hamilton & Niagara Falls Electric Ry. Co. has been incorporated by John Fleet, H. H. Dewart and J. T. Gilmour, and R. W. Scott, of Ottawa.

ELECTRIC LIGHT AND POWER.

REEDSBORO, VT.—At a special town meeting March 30 it was voted to exempt from taxation for five years all the property of the Hoosac Electric Power & Mfg. Co., which proposes to develop electricity at Howe's Pond, in this town, for transmission to North Adams, Williamstown and other places in Massachusetts. This project was noted in our issue of Feb. 21. W. S. Kelly, of the General Electric Co., Boston, is interested.

ARLINGTON, MASS.—Plans are being prepared for an electric light plant, estimated to cost about $49,000. A town meeting will be held April 6 to vote on the question.

HOLYOKE, MASS.—Bids are asked by the committee until April 22 for furnishing 235 arc lights—or 1,200 incandescent lights—for three years. R. S. Burns, Chn.

CLYDE, N. Y.—H. B. Stevens, of Rochester, Pres. Clyde Gas Works, has petitioned the council for permission to erect an electric light plant.

NORTH TONAWANDA, N. Y.—The governor has signed a bill authorizing this city to establish an electric light plant.

WAVERLY, N. Y.—The citizens of South Waverly voted April 9 on a proposition to make an appropriation for electric lights.

ATLANTIC CITY, N. J.—Bids are asked until April 15 for furnishing 101 arc lights for one to five years. E. D. Irelan, Cy. Clk.

EAST ORANGE, N. J.—The plant of the Crocker-Wheeler Electric Co., covering about seven acres, at Ampere Station, was destroyed by fire April 7, causing a loss of $250,000. Pres., Schuyler S. Wheeler; Secy. and Treas., F. M. Jeffery.

MARION, VA.—It is reported that the construction of an electric light plant, to be operated by a 50-HP. water wheel, is being considered. Address C. A. Sprinkle.

ATLANTA, GA.—Luther Steiringer is preparing completed plans for electric displays for the exposition.

STATESBORO, GA.—It is reported that W. D. Davis will put in an electric light plant.

MURFREESBORO, TENN.—A bill has been introduced in the legislature authorizing an issue of $25,000 in bonds for an electric light or gas plant.

VERSAILLES, KY.—W. S. Berry, Cy. Clk., writes us that as soon as specifications are completed for an electric light plant the city will receive bids for its erection.

NEWCOMERSTOWN, O.—The citizens have voted to issue $30,000 in bonds for electric lights and waterworks.

RUSHVILLE, IND.—A. R. Herkless, of the Rushville Water, Light & Power Co., has petitioned for permission to purchase the electric light plant.

CHICAGO, ILL.—Bids are asked until April 17 for lighting the streets with electricity for the remainder of the year. H. J. Jones, Cy. Comptroller.

COLFAX, ILL.—J. A. Crawford and R. E. Meharry have been granted a 20-year franchise for an electric light plant.

CHILTON, WIS.—The citizens have voted in favor of electric lights.

OSHKOSH, WIS.—The citizens voted April 2 on a proposition to erect an electric light plant.

ST. PAUL, MINN.—A bill has passed the legislature appropriating $30,000 for buildings and an electric light plant at the soldiers' home.

RANDOLPH, NEB.—Geo. W. Wiltse, Village Clk., writes us that the village board is considering a proposition from W. R. Boughn to put in an electric light plant, but that the proposition has not yet been accepted.

BARNARD, MO.—It is stated that the question of putting in an electric light plant is being discussed.

EL DORADO SPRINGS, MO.—The aldermen have granted a 21-year franchise to W. B. Lewis for an electric light plant, work on which must begin at once.

MONTREAL, QUE.—Press reports state that the Lachine Rapids Hydraulic & Land Co. has been organized to utilize the water power of the Lachine Rapids from Isle aux Huron to the Montreal shore. A dam about 3,500 ft. in length is to be constructed. A power house is to be built, which will contain 72 turbine wheels and 12 dynamos of 750 HP. each.

NEW COMPANIES.—Texas Electric Co., Austin, Tex.; $5,000; C. L. Horton.

Wolverine Electric Co., Detroit, Mich.; Chas. F. Scott, H. A. Marks.

Charleston Electric Co., Charleston, Ill.; $5,000; Richard Cadle, Frank A. Brooks.

Osburn Electric Supply Co., Chicago, Ill.; $12,000; Henry G. Osburn, Asa W. Waters.

Tacoma Gas & Electric Light Co., Tacoma, Wash.; $350,000; E. Seymour, Chas. B. Hurley.

People's Electric Light & Power Co., Calais, Me.; $50,000, with $1,000 paid in; Pres., John G. Murchie.

Standard Telephone & Electric Co., Minneapolis, Minn.; $50,000; S. S. Kilvington, E. W. Batchelder, H. C. Dodge.

Waco Electrical Supply & Construction Co., Waco, Tex.; $10,000; W. W. Seeley, S. A. Hobson, A. P. Moore, Eugene Early.

W. H. Elliott Electric Co., Cleveland, O.; $10,000; to manufacture electrical machinery; Robt. M. Fuller, Theo. C. Volman, and Wm. H. Elliott.

San Joaquin Electric Co., Fresno, Cal.; $800,000, with $80,000 paid in; John J. Seymour, John S. Eastwood, Henry Sherwood, O. J. Woodward and L. L. Cory.

BRIDGES.

BOSTON, MASS.—A committee representing the councils of this city and Cambridge is reported to have voted to direct the city engineers of both cities to prepare plans for a new bridge across the Charles River.

PROVIDENCE, R. I.—It is stated that the city engineer will probably submit plans for a bridge over the Moshassuck to connect Promenade St. and Exchange Place. The bridge will be about 70 ft. wide and 70 ft. long, and is estimated to cost, with a center pier, $25,000.

MIDDLETOWN, CONN.—Press reports state that the parties interested in the proposed bridge between this city and Portland believe that all obstacles will be overcome and the bridge constructed and ready for travel by another year.

BINGHAMTON, N. Y.—Bids are asked until April 22 for constructing an iron bridge on Park Ave., as stated in our advertising columns. Lewis Seymour, Cy. Clk.

BUFFALO, N. Y.—Bids are asked by the department of public works until April 23 for constructing a bridge 83 ft. wide on Niagara St., over Scajaquada Creek.

CARTHAGE, N. Y.—It is stated that arrangements are being made for the early construction of the new bridge between this place and West Carthage, for which $25,000 was recently appropriated.

GLOVERSVILLE, N. Y.—E. B. Baker, Cy. Engr., writes us that the contract for a bridge, for which bids were opened last week, has been awarded to the King Bridge Co., at $761, the other bids being as follows: Vermont Construction Co., $835; S. E. Ferguson, $875; Dean & Westbrook, $1,015; Nelson & Buchanan, $1,015; Berlin Bridge Co., $1,021; Canton Bridge Co., $1,050; Wrought Iron Bridge Co., $1,080; Horseheads Bridge Co., $1,096; Owego Bridge Co., $1,100; Groton Bridge & Mfg. Co., $1,120, $1,095 and $1,160; Milan Arch Construction Co., $1,525 and $1,290.

HAMBURG, N. Y.—A. C. Stolting, Village Clk., writes us that the town has voted $4,000 for an iron bridge over Eighteen-mile Creek at Water Valley, and a contract for the construction awarded to the Penn Bridge Co., at $3,150.

HAVANA, N. Y.—The Havana Bridge Works, of Montour Falls (formerly Havana) has been incorporated, with a capital stock of $30,000; directors, R. T. Turner, L. G. Rathbun, M. D. Doxey and C. J. Root, of Elmira; C. D. Clausen, J. D. Shepard and F. H. Shepard, of Montour Falls.

LUZERNE, N. Y.—The proposition to build a bridge to Corinth was carried at a recent election.

NEWARK, N. Y.—The governor has signed a bill appropriating $8,000 for an iron bridge across the canal at Main St., in this village.

NEW YORK, N. Y.—A bill has been introduced in the legislature authorizing an expenditure of $1,500,000 for a drawbridge over the Harlem River at 145th St.

SALAMANCA, N. Y.—The contract for building a new iron bridge on Main St. has been awarded to the Groton Bridge & Mfg. Co., at $3,000.

ASBURY PARK, N. J.—Plans have been prepared for a bridge across Grand Ave. The bridge will be 72 ft. wide, with a 50-ft. roadway.

PHILADELPHIA, PA.—It is reported that contracts will soon be awarded for the construction of the first 20 miles of the Pittsburg & Eastern R. R., the work to include three bridges over the Susquehanna River, each over 300 ft. in length. Pres., C. C. Watt; Gen.Man., S. H. Hicks; Ch. Engr., J. C. Patterson, Bullitt Bldg.

ROME, GA.—Bids are asked until April 20 for the construction of an iron bridge 16 ft. wide, the cost not to exceed $1,200; also for the erection of two piers. Max Meyerhardt, Clk. Comrs.

DANDRIDGE, TENN.—The plans submitted by Col. Morris Cope, of Chattanooga, representing the New Columbus Bridge Co., of Columbus, O., have been accepted by the county court, and it is stated that this company will construct the bridge as soon as the court takes definite action.

ASHTABULA, O.—At the election April 1 the citizens voted by a majority of 138 to issue $25,000 in bonds for a high level bridge at Spring St.

CAMBRIDGE, O.—O. M. Hoge, County Engr., has been directed to prepare plans for a wrought iron bridge over Wills Creek, in this city: length of span, 144 ft.; width of roadway, 18 ft.; capacity, 125 lbs. per sq. ft.

CINCINNATI, O.—The county commissioners have directed the engineer to prepare specifications for a bridge over Little Duck Creek, on the Camargo Pike, east of Madisonville.

PLYMOUTH, IND.—Bids are asked until May 10 for the construction of a bridge 220 ft. long across the Tippecanoe River, one mile north of Ilion. O. R. Porter, County Audr.

WATERLOO, WIS.—A railway bridge three miles east of this village, on the Watertown Division of the Chicago, Milwaukee & St. Paul Ry., was burned March 29.

DULUTH, MINN.—The city engineer has been directed to prepare plans for an iron bridge across the St. Louis River at Fond du Lac, provided the state appropriates $15,000 towards the work.

CHEYENNE, WYO.—The construction of a bridge across the North Platte River has been postponed until fall. Two 40-ft. wooden bridges on new roads to be opened, across Sibylle Creek, will be built this season. Walter D. Pease, County Surv.

CAMERON, MO.—The Dildine Bridge & Construction Co. was incorporated April 4; capital stock, $10,000, commencing with $5,000; incorporators, E. L. Dildine, O. M. Young, M. B. Jones and E. T. Walker.

ST. LOUIS, MO.—Local papers state that W. Frank Street, a prominent South End banker, has been reliably informed that the Chicago, Burlington & Quincy R. R. has secured the franchises, and has made soundings and surveys preparatory to building a bridge across the Mississippi River at Carondelet, and that the construction will be commenced at an early date.

DENVER, COLO.—Bids are asked until April 16 for removing and re-erecting the old iron bridge across Cherry Creek at Broadway. The bridge now has four Pratt trusses, and it is proposed to add the necessary new material and make from this two high-way bridges with tubular foundations. Arthur C. Harris, Pres. Bd. Pub. Wks.

LOS ANGELES, CAL.—Bids are asked until May 6 for the construction of a steel bridge, with a 60-ft. span and for a bridge with three spans of 60 ft. each. J. W. F. Bliss, Clk. Supervisors.

LONDON, ONT.—It is stated that two new bridges will be built across Kettle and Mill creeks at St. Thomas, at a cost of $25,000 to $30,000 each.

BUILDINGS.

BOSTON, MASS.—Plans are being prepared by John P. Putnam for the Commonwealth hotel on Commonwealth Ave., estimated to cost $3,000,000. The building will be 11 stories high, covering 150,000 sq. ft., and will contain about 2,250 rooms. Alexander S. Porter, Chas. F. Adams, Francis A. Osborn, and Chas. P. Bowditch are reported as interested.

ALBANY, N. Y.—The construction of a union passenger station somewhat similar to the station in New York is being considered.

BINGHAMTON, N. Y.—The Delaware, Lackawanna & Western R. R. Co. is considering the question of building a new station at this place.

BROOKLYN, N. Y.—A syndicate with a capital stock of $5,000,000 has purchased the property bounded by Broadway, Myrtle Ave., Lewis Ave. and Stockton St., and formerly occupied by the Brooklyn City R. R. Co. as stables, for $400,000. It is proposed to build a large place of amusement. Nathan Levi and Moses May are interested.

DAVIDS ISLAND, N. Y. H.—Bids are asked until April 22 for constructing bachelors' quarters and dormitories. J. W. Summerhayes, Asst. Q. M., U. S. A.

JAMESTOWN, N. Y.—We are informed that at a special election April 2 the taxpayers voted to erect a city hall, estimated cost about $67,000, for which bonds will be issued.

NEW YORK, N. Y.—Plans have been filed by T. W. Mertens, Seventh Ave. and 113th St., for a 7-story brick flat, to cost $111,000; by the Metropolitan Life Insurance Co., 12-story brick office building, to cost $350,000; and by St. Paul's Methodist-Episcopal Church, 445 West End Ave., 4-story brick church and parsonage at West End Ave. and 86th St., to cost $200,000.——The governor has signed a bill authorizing the city to issue $500,000 in bonds for enlarging the building in Central Park occupied by the American Museum of Natural History.——It is reported that a 15-story office building is to be erected at Nassau and Liberty Sts., estimated to cost $1,000,000. Archs., Lamb & Rich.

NEW YORK, N. Y.—It is reported that preparations are being made for the construction of the Bar Association building on Sixth Ave., between 44th and 43d Sts., estimated to cost $250,000. Arch., Cyrus L. W. Eidlitz; Pres., Joseph Larocque; Recording Secy., Silas B. Brownell.——Plans have been filed by F. J. Schnugg, 101st St. and Madison Ave., for an 8-story brick flat, to cost $144,000; by Young Men's Christian Association, 316 to 320 West 57th St., 6-story brick building, to cost $200,000, and by Louis M. Jones, Broadway and Eighth St., 9-story brick store, to cost $175,000.

NORTH EVANS, N. Y.—Bids are asked until April 19 for constructing a school house in Evans. Address Fayette Read.

PLATTSBURG, N. Y.—Bids are asked until May 1 for building a drill hall. Capt. Geo. A. Pond, U. S. A.

WEST POINT, N. Y.—Bids are asked until May 15 for constructing a memorial hall, as stated in our advertising columns. Archs., McKim, Mead & White, 160 Fifth Ave., New York; Capt. J. B. Bellinger, U. S. A.

JERSEY CITY, N. J.—The street and water board has adopted plans for the erection of a 200×104-ft. school building on Brunswick St., estimated to cost $95,000.

PHILADELPHIA, PA.—Bids are asked until April 17 for the erection of a 12-story warehouse for the Fidelity Storage & Warehouse Co. Arch., Charles Balderston, 144 South Fourth St.

PHILADELPHIA, PA.—Bids are asked until Oct. 1 for plans and specifications for an art building in Fairmount Park, prizes for which will be awarded as follows: 1st prize, $6,000 for the plans and specifications of the building that shall be adopted; 2d prize, $3,000; 3d prize, $2,000; 4th prize, $1,000. Russell Thayer, Ch. Engr. and Supt. Fairmount Park.

ATLANTA, GA.—Plans have been prepared by G. L. Normann for a 10-story granite hotel, to be built by W. H. Venable and Samuel Venable.

SPARTA, TENN.—White county has been authorized to erect a new court house, plans for which are solicited. The committee consists of J. D. Goff, E. S. Beeding, J. R. Thompson and J. A. Mays.

CINCINNATI, O.—Plans are being prepared for a 14-story theatre and office building at Sixth and Vine Sts. It is reported that the management of the Heuck Opera House is interested.

DETROIT, MICH.—The committee is considering sites for the erection of a combined county and city building, estimated to cost $1,500,000. Chn., Thomas McGraw.

BLOOMINGTON, ILL.—Bids are asked until May 1 for the erection of a post office building in this city. Wm. M. Aiken, Supervising Arch., Washington, D. C.

CHICAGO, ILL.—Bids are asked until April 15 for building a jail on Dearborn Ave. and Illinois St. T. N. Jamieson, Supt. Pub. Service, 205 County Bldg.

HELENA, MONT.—Bids are asked until April 26 for the erection of two double sets of officers' quarters at Fort Harrison. Capt. Geo. S. Hoyt, Asst. Q. M., U. S. A.

LINCOLN, NEB.—The contract for the completion of the library building for the University of Nebraska has been let to Grace & Kelly, of Lincoln, at $49,400. The building will be of mill construction, with a fireproof

book storage wing, and will cost complete about $100,000. Archs., Fisher & Lawrie, Omaha; Supt. of Const'n, G. H. Ellsworth, Lincoln.

GALVESTON, TEX.—Bids are asked until April 22 for the erection of a 3-story bank building at 24th and Strand Sts. Archs., N. J. Clayton & Co.

LIBERTY, TEX.—Bids are asked until May 13 for plans and specifications for a brick or stone court house, to cost not more than $40,000. W. A. Neyland, Judge of Liberty county.

PARRIS, CAL.—Bids are asked for constructing a hospital building at the U. S. Industrial School. Supt., Edgar A. Allen.

OTTAWA, ONT.—Bids are asked until April 30 for the erection of a post office building at Rimouski Ave. E. F. E Roy, Secy. Dept. Pub. Wks.

WATER-WORKS.

AUBURN, ME.—The water board is reported to have voted to spend $6,000 this summer in extending the mains.

DANFORTH, ME.—It is stated that works will be put in this summer.

MECHANIC FALLS, ME.—J. H. De Coster, Clk., writes us that the town has voted to rent not less than 32 hydrants for 20 years at $1.600 a year. J. W. Penny is chairman of the committee appointed to investigate the question, as noted in our issue of March 28.

WILTON, ME.—J. E. Hiscock, Town Clk., writes us that the Wilton Lake Water Co. is being organized to put in works for fire protection. It is proposed to purchase a 50-HP. water wheel, a No. 5 Gould pump, 400 ft. of 6-in. pipe and a short line of 4-in. pipe and a quantity of fire hose. The works will be put in not later than June.

BOSTON, MASS.—Bids are asked by the water board until April 23 for about 1,400,000 cu. yds. of earth excavation and other work for building roads at basin No. 5; seven contracts.

CAMBRIDGE, MASS.—The contract for building the Winter St. dam has been awarded to the Standard Construction & Supply Co., of Easton, Pa., at $116,272. The itemized bids are published under Contract Prices. Cy. Engr., L. M. Hastings.

NORTH BROOKFIELD, MASS.—At a special town meeting April 8 the town voted, 165 to 50, to raise $20,000 for the extension of the water system and to add this amount to the tax levy. This action makes it unnecessary to apply again to the legislature for permission to borrow this amount.

QUINCY, MASS.—The commissioners have asked for an appropriation of $45,000 for extending the mains and erecting a stand-pipe at Wollaston.

SHEFFIELD, MASS.—H. S. Andrews, W. H. Dresser, W. H. Little and others have been granted a charter for the Sheffield Water Co., to put in works at this place.

SOMERVILLE, MASS.—The council is considering the question of securing a supply from wells.

SOUTHAMPTON, MASS.—C. P. Gridley, Chn. Selectmen, writes us that nothing is being done about works this year.

WEBSTER, MASS.—The town has voted to petition the legislature for authority to issue $20,000 in bonds for water-works purposes.

WOONSOCKET, R. I.—The contract for constructing the dam for storage reservoir No. 3 has been awarded to J. B. Riley & Co., of Trenton, N. J., at $35,170. There were nine lower bidders. Two of the three water commissioners have been suspended pending an investigation of the award. The itemized bids will probably be published next week.

ANTWERP, N. Y.—It is reported that the question of issuing $30,000 in bonds for works will soon be voted upon.

BROOKLYN, N. Y.—Bids are asked until May 9 for furnishing and erecting pumping engines with capacity aggregating 60,000,000 gallons of water daily, as stated in our advertising columns. Alfred T. White, Comr. Cy. Wks.

BUFFALO, N. Y.—The special committee has reported in favor of improvements to cost about $1,000,000, including 5,100 ft. of intake tunnel, to cost $275,625, two 30,000,000-gallon pumping engines, etc.

BUFFALO, N. Y.—Bids are asked until April 23 for excavating and refilling trenches for the laying of water pipe during 1895. The contract was worth about $75,000 last year. R. G. Parsons, Secy. Pub. Wks.

CARTHAGE, N. Y.—The majority of the taxpayers of West Carthage are reported to have signed a petition in favor of calling a special election to vote on an appropriation of $25,000 for works.

CASTLETON, N. Y.—C. E. Buckman, Village Clk., writes us that nothing is now being done in regard to works, and it does not seem probable that construction will be commenced this year. Plans have been prepared, but a good many taxpayers are not in favor of the project.

CORNWALL-ON-HUDSON, N. Y.—Alexander Potter has been engaged to prepare plans for works, estimated to cost $80,000. The work will probably be advertised in about three weeks. C. D. Stone, Pres. Comrs.

CENTRAL BRIDGE, N. Y.—The question of constructing works continues to be discussed.

DANSVILLE, N. Y.—The village trustees have engaged John Young, of Geneseo, N. Y., to make a survey and map of the village for $250. Mr. Young offers to submit estimates for a water-works plant for $200 and for a sewerage system for $50 additional.

DEPEW, N. Y.—It is reported that bids may be asked within a few weeks for a new pumping engine.

MADISON, N. Y.—C. S. Lewis, Clk., writes us that nothing has been done for works since the appointing of a committee to investigate the question.

MOUNT MORRIS, N. Y.—The Murray Hydraulic Co. has been organized by local and other capitalists to put in works and a sewer system. The company has purchased springs owned by G. A. Parker and George Mattocks, and has petitioned for a franchise.

OLEAN, N. Y.—Steps are being taken by the residents of North Olean to secure a municipal plant, estimated to cost about $15,000. D. W. Seeley, Village Pres.

PAWLING, N. Y.—We are informed that the following bids were received March 30 for constructing works, as advertised in Engineering News; Engrs., the Stanwix Engineering Co., Rome, N. Y.:

Seymour & Banker, Gloversville, N. Y.	$25,000
Smith Bros., Pelhamville, N. Y.	25,516
Wild Engr. Co., Valatie, N. Y. (awarded contr't)	26,852
C. J. & B. J. Coons, Kingston, Pa.	27,260
Gibney & Orndorf, Fort Plain, N. Y.	28,120
A. F. Nims, Elkhart, Ind.	28,700
John Marsden, Utica, N. Y.	29,191
Lehigh Valley Const 'n Co., So. Bethlehem, Pa.	29,200
Thomas McCormick & Co., Sing Sing, N. Y.	29,486
Clinton Beckwith, Herkimer, N. Y.	30,353
Dougherty & Barrigan, Yonkers, N. Y.	30,992
R. J. Bellew and C. H. Merritt, Tuckahoe, N. Y.	31,498
F. M. Leisher & Sons, Easton, Pa.	31,900
Flood & Sherrill, Sandy Hill, N. Y.	31,936
Salvator Chariot, South Norwalk, Conn.	32,250
Peter Sweeney, Danbury, Conn.	34,132
James Sico, East Irvington, N. Y.	34,350
Fairbanks, Morse & Co., St. Paul, Minn.	34,380
Warren Contracting Co., New York, N. Y.	34,616
J. R. Byron, Mt. Vernon, N. Y.	35,000
E. Hostetter & Curran, Poughkeepsie, N. Y.	37,318

POUGHKEEPSIE, N. Y.—The superintendent has been authorized to advertise for bids for a new boiler.

ROCHESTER, N. Y.—Plans are reported to have been completed for a large storage reservoir, to cost nearly $150,000, on Cobb's Hill.

SAVONA, N. Y.—There is talk of constructing works, estimated to cost about $12,000.

SYRACUSE, N. Y.—The commissioners are reported as planning to lay about 60 miles of pipe this summer, if the legislature grants the desired permission to issue bonds.

THERESA, N. Y.—This village is reported as considering the question of constructing works.

TULLY, N. Y.—It is reported that a committee will soon be appointed to secure estimates as to the cost of works.

WAVERLY, N. Y.—An election was held April 9 at South Waverly to vote on the question of a water supply and electric lights.

CLAYTON, N. J.—The contract with the American Pipe Co. for works was signed April 6. It is stated that 10-in. mains will be laid and 35 fire hydrants put in.

GARFIELD, N. J.—The Garfield Water Co. was incorporated April 4 to construct works at this place; capital stock, $25,000; incorporators, H. W. Southworth, Wm. I. Ticknor and A. G. Duysters, of New York; J. S. Purdy, W. C. Foster and J. B. Lydecker, of Rutherford, and E. E. Curtis, of Allendale, N. J.

MEDFORD, N. J.—I. W. Garwood, Secy. Medford Water Co., writes us that bids will be asked for constructing works as soon as specifications are ready; work will include a stand-pipe; estimated cost, $9,000; proposed supply from creek; population of city, 1,000; no engineer yet engaged.

BRADDOCK, PA.—The council is reported about to extend the service into the new Fourth Ward.

DRIFTWOOD, PA.—It is reported that works, to cost $12,000, will be put in this summer.

HARRISBURG, PA.—The Paxtang Water Co. is reported about to apply for a charter; capital stock, $5,000; works will include a reservoir.

MARYSVILLE, PA.—The Marysville Water Co. was incorporated April 3; capital stock, $30,000, commencing with $3,000; Treas., John A. Herman, Harrisburg.

McKEESPORT, PA.—The committee appointed to secure a better water supply is reported to have recommended that estimates be secured for sinking five artesian wells.

NEW HOLLAND, PA.—The New Holland Water Co. was incorporated April 4; capital stock, $25,000, commencing with $2,500; Treas., Harry K. Stolb.

NICHOLSON, PA.—The question of issuing bonds for new works, unless the company will sell its plant at a reasonable price, is again being agitated.

PERKASIE, PA.—The Perkasie Water Co. was incorporated April 8; capital stock, $20,000, commencing with $2,000; Treas., J. A. Hendricks.

SELLERSVILLE, PA.—An election will be held May 7 to vote on an issue of $20,000 in bonds for new works, which will probably include a 30,000-gallon reservoir, about 20,000 ft. of 6 and 4-in. pipe, 30 or 40 hydrants, etc.; population, 1,500. W. Cressman, Borough Engr.

SHAMOKIN, PA.—C. Q. McWilliams, Treas. Roaring Creek & Shamokin Water Co., writes us that the construction of a 350,000,000-gallon storage reservoir has been commenced. The work is being done by the company, the pipe being furnished by R. D. Wood & Co.

WEST BROWNSVILLE, PA.—There is talk of constructing works, according to reports.

LONACONING, MD.—A correspondent writes us that this town has granted a 35-year franchise for gravity works to Malcolm Sinclair, of Cumberland, Md., the town to take not less than 33 hydrants at $33½ each a year. Engrs., Hoge & White, Wheeling, W. Va.

ROCKVILLE, MD.—John L. Burnett, Cy. Clk., writes us that the council has not yet taken any action in regard to putting in works, and probably will not for the present.

WASHINGTON, D. C.—Bids are asked by the district commissioners until April 20 for furnishing water meters, as stated in our advertising columns.

NORFOLK, VA.—Bids are asked until April 20 for securing a daily supply of 2,000,000 gallons of water from driven wells, as stated in our advertising columns. R. Y. Zachary, Supt.

SALEM, W. VA.—J. H. Benedum, Recdr., writes us that upon investigation it was found that the $3,000 voted for works was insufficient, and that another election will be held to vote on an issue of $5,000 in bonds for works.

KINSTON, S. C.—J. T. Heath, Clk., writes us that an election will be held within 30 days to vote on the question of works; no steps yet taken; population, 3,500.

PELHAM, N. C.—The Southern Ry. Co. is reported about to erect a new 60,000-gallon water tank at this place.

NEW ORLEANS, LA.—Bids are asked by the New Orleans Water-Works Co. until April 15 for laying about 3,500 ft. of 8-in. pipe.

HOPKINSVILLE, KY.—The asylum commissioners are securing estimates for works at the asylum. It is probable that arrangements will be made with Jesse W. Starr, who has the contract to construct works in the city, to extend the service to the asylum.

CARTHAGE, O.—A proposition to issue $15,000 in bonds to extend the mains has been defeated.

CLEVELAND, O.—The board of control has recommended that the contract for a riveted steel water pipe crossing the Ohio Canal at Dennison Ave. be awarded to the Excelsior Iron Wks. Co., at $1.544, the other bidders being the River Machine & Boiler Co., $1,945; Variety Iron Wks. Co., $2,945; Daniel Connelly, $2,587; H. E. Teachout Boiler Wks., $2,650.

DAYTON, O.—Plans have been prepared for extensions of the mains in a large number of streets.

LORAIN, O.—Samples of lake water are being analyzed with a view of ascertaining how far the intake will have to be extended to secure a pure supply.

MILLERSBURG, O.—The city clerk writes us that the citizens have voted, 345 to 57, to issue $20,000 in bonds for works; population, 2,000.

NEWCOMERSTOWN, O.—The citizens have voted to issue $30,000 in bonds for works and electric lights.

WAUSEON, O.—The corporation clerk writes us that no steps have yet been taken to secure works, although the question is being agitated.

WELLINGTON, O.—The proposition to issue $15,000 in bonds in addition to the $35,000 voted last fall for a gravity system of water-works was defeated April 1 by eight votes.

YELLOW SPRINGS, O.—E. F. Layman, of Cincinnati, is preparing plans for works at this place.

FORT WAYNE, IND.—O. N. Oakley, Mayor, has suggested that a water supply be secured from Fish Lake, about 30 miles distant, and a committee has been appointed to investigate the feasibility of the project. It is said that this lake has an elevation of 100 ft. above the city.

MADISON, IND.—The council is reported to have leased the works for 15 years to Stubbing & Walsh, at $6,200 a year. The contractors are required to put in a new 1,000,000-gallon pumping engine, etc., as stated in our issue of March 28.

RUSHVILLE, IND.—A. R. Herkless, representing the Rushville Water, Light & Power Co., has petitioned the council for a franchise for works and an electric light plant.

HOLLAND, MICH.—The proposition to issue $6,000 in bonds for extensions, as noted last week, was carried by about 600 majority. Geo. H. Sipp, Cy. Clk.

BUDA, ILL.—At an election April 6 the citizens voted to issue $20,000 in bonds for works.

CENTRALIA, ILL.—The council is reported as planning to erect a dam on Crooked Creek for the construction of an additional storage reservoir.

PARIS, ILL.—The council has engaged Geo. H. Simson, of Terre Haute, Ind., to investigate the question of a water supply.

ROCKFORD, ILL.—The committee has recommended that 8 to 2-in. mains be laid in 10 streets.

SPRINGFIELD, ILL.—The village of West Springfield is discussing the construction of works. H. A. Stevens, Village Attorney, is interested.

ADEL, IA.—A committee is investigating the question of works and it is stated that contractors are already submitting bids for the construction.

CALMAR, IA.—The city recorder writes us that the water-works proposition was defeated at the recent election.

CENTERVILLE, IA.—The city is reported to have voted to issue $55,000 in bonds for works. J. P. Gribben, Cy. Clk.

OELWEIN, IA.—The new council is reported as taking steps to put in works.

MINNEAPOLIS, MINN.—The special council committee has voted in favor of constructing the new reservoir by contract and of spending the entire $275,000 this year.

MONTGOMERY, MINN.—The village council has contracted with Fairbanks, Morse & Co. to extend the mains to East Montgomery.

HAVENSVILLE, KAN.—R. C. Coverdale, Mayor, writes us that an election was held April 1 to issue $2,500 in bonds for works, which will include a 1,000-bbl. tank, a 12-ft. windmill, 60-ft. tower, about 3,000 ft. of pipe and 9 hydrants; no plans yet prepared.

BELLE FOURCHE, S. DAK.—J. B. Berry, of Omaha, Ch. Engr. Fremont, Elkhorn & Missouri Valley R. R., is reported as having located four large reservoirs, having a capacity of 1,500,000,000 gallons, in the cattle country in this vicinity. It is stated that the contracts for the work will be awarded this week.

SALEM, S. DAK.—Bids are asked for the purchase of $1,200 worth of 6 and 4-in. cast iron pipe, with other supplies for extensions of the water mains. M. A. Blackburn, Supt.

VERMILLION, S. DAK.—The water company is reported to have agreed to sink four additional wells and make other improvements.

EDMOND, OKLA.—The question of works is being agitated at this place.

KILLEEN, TEX.—A company has been organized with a capital stock of $2,500 to construct works; supply to be from artesian wells. Pres., A. W. Dunn; Secy., Levi Anderson; Treas., R. M. Cole.

LA GRANGE, TEX.—The city works and electric light plant has been purchased by Taylor & Bradshaw.

MORGAN TEX.—J. W. Gilpin, Town Secy., writes us that a franchise for works has been granted to Morton & Tittle, who will commence the construction at once; supply from artesian well; population, 700.

PITTSBURG, TEX.—J. W. Hill, Mayor, writes us that nothing definite has yet been done toward putting in works. The question is being agitated with some prospect of success. Population, 2,000.

TEMPLE, TEX.—The Temple Water-Works Co. has filed a mortgage to secure an issue of $150,000 in bonds, including $90,000 for a new 16-in. main, a reservoir and other improvements, as recently noted in these columns.

WEATHERFORD, TEX.—W. S. Fant, Receiver, writes us that he has awarded a contract for a well 410 ft. deep to W. B. Sharp, of Dallas. The well is to be cased full 8 ins. and be fitted with A. B. Cook's deep-well pumps.

WEIMAR, TEX.—The water-works proposition was defeated last week by 87 votes.

IDAHO SPRINGS, COLO.—The proposition to issue $20,000 in bonds to extend the works was carried at the election April 2. J. G. Weeks, Mayor.

BALLARD, WASH.—Bids are asked until April 9 for sinking a number of tubular wells for a water supply, and bids will be received until April 12 for furnishing material for constructing works, including 24,900 ft. of 12 to 4 in. cast iron or kalamein pipe, 38 valves and 30 hydrants; and until April 15 for pipelaying, etc., for the construction of works. Cy. Engr., S. K. Smith; Cy. Clk., G. W. Emerson.

SAN BERNARDINO, CAL.—The San Bernardino Valley Water Co. was incorporated April 4, with a capital stock of $24,000, all paid in, by H. L. Drew, A. L. Drew, Chas. W. Fairbanks, and others.

SEWERAGE.

PORTLAND, ME.—Rudolph Hering, of New York, has recommended the construction of 16,650 ft. of sewers, estimated to cost $133,637, to relieve the Back Cove. A pumping station would be required.

HUDSON, MASS. The legislature has authorized this town to construct a system.

MELROSE, MASS.—Bids are asked by the commissioners until April 13 for building section 1 and portions of sections 5 and 7 of the system.

WINTHROP, MASS.—Bids are asked by the sewer committee until April 13 for furnishing 54,000 ft. of 15 to 4-in. sewer pipe. Engr., H. T. Whitman, 85 Devonshire St., Boston.

ALBANY, N. Y.—The council has passed an ordinance authorizing the construction of the Beaver Creek sewer, estimated to cost $85,000.

ALBION, N. Y.—The question of constructing a system, estimated to cost $66,000 to $81,000, will be voted upon April 18.

BINGHAMTON, N. Y.—It is proposed to construct about 1,900 ft. of 10 and 8-in. pipe sewers, estimated to cost about $2,400. Lewis Seymour, Cy. Clk.

FAR ROCKAWAY (L. I.), N. Y.—The sewer commissioners have engaged Alexander Potter, of New York, to prepare plans for a system of sewers and sewage disposal for the village. A plan which involved the adoption of a chemical precipitation system was defeated last year.

MOUNT MORRIS, N. Y.—The Murray Hydraulic Co. has been organized to put in a sewer system and water-works plant. The company has petitioned for a franchise.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2622 Third Ave., until April 17, for constructing sewers in two streets.

SYRACUSE, N. Y.—Henry C. Allen, Cy. Engr., writes us that the map showing the extension and improvement of the system, prepared by Samuel M. Gray, of Providence, R. I., has been presented to the council. A beginning of the work designed has been made, and on April 8 the council ordered the construction of sewers in several parts of the city, estimated to cost about $67,000. It is probable that bids will be advertised for within the next four weeks.

WILLIAMSBRIDGE, N. Y.—Bids are asked until May 1 for constructing about 20 miles of sewers, as stated in our advertising columns. Engr., M. J. Mack; Pres. Comrs., Wm. A. Keating.

ROSELLE, N. J.—The council has passed ordinances for the construction of sewers in 10 streets. The contracts for the outlet sewer has been awarded to Wm. H. Watters. G. A. Rawlins, Borough Clk.

JERSEY CITY, N. J.—The commissioners have decided to extend the Mersells St. sewer to relieve Mill Creek, at an estimated cost of $35,000.

TRENTON, N. J.—The council has voted to construct a sewer in South Broad St. C. E. Murray, Cy. Clk.

ALTOONA, PA.—Rudolph Hering, of New York, has recommended the extension of the system by the construction of 37 to 30-in. sewers, and the building of two sewage disposal plants, one estimated to cost $60,000, and the other $40,000. Harvey Linton, Cy. Engr.

CARBONDALE, PA.—The mayor has recommended the extension of the system.

LANSDALE, PA.—Plans are being prepared for a system, with outlet into Neshanimy Creek.

WILKES BARRE, PA.—The committee has recommended that bids be asked for the construction of sewers in 15 streets.

CINCINNATI, O.—Bids are asked by the board of administration until May 6 for constructing sewers in five streets.

TOLEDO, O.—Bids are asked until April 15 for constructing 24-in. brick sewers in three streets. L. P. Harris, Cy. Clk.

GREENFIELD, IND.—Phillips & Goss are making surveys for a system.

RICHMOND, IND.—Bids are asked until May 3 for constructing a sewer, 2,376 ft. of which will be brick and 3,672 ft. pipe. H. L. Weber, Cy. Engr.

MENDOTA, ILL.—The construction of a system is being considered. The deepest cut would be 21 ft. A sewage disposal plant would be required, estimated to cost about $20,000.

BURLINGTON, IA.—William Steyh, Cy. Engr., writes us that the rebuilding of the Valley St. sewer at present is still in doubt. It is probable that the work will be postponed until after a heavy flood has destroyed it so that all arguments against the work must cease.

MUSCATINE, IA.—The council has adopted an ordinance for constructing 10 and 6-in. pipe sewers in several streets.

CARTHAGE, MO.—Press reports state that the county court is planning to co-operate with this city in building a part of a sewer system extending from the new $100,000 court house to the river. The court will in its part of the work use about 60 county prisoners. After the sewer is built the prisoners will be worked on the road.

JEFFERSON CITY, MO.—E. F. C. Harding, Cy. Engr., writes us that the contract for constructing a main sewer, as advertised in Engineering News, has been awarded to Geo. Baer, the total bids being as follows:

Fruin-Bambrick Const'n Co., St. Louis	$11,176
Penny-Myers Const'n Co., St. Louis	8,494
Matt & Roberts, Jefferson City, Mo.	8,958
H. S. Dewey, Jefferson City, Mo.	9,095
Hill-O'Meara Const'n Co., St. Louis, Mo.	10,066
W. H. Kalkinger & Co., Jefferson City, Mo.	9,813
Hussey & Thies, St. Louis, Mo.	8,106
Geo. J. Baer, Kansas City, Mo.	7,672

MARYSVILLE, CAL.—F. E. Smith, Cy. Clk., writes us that the council may take some action at its next meeting in regard to the construction of a system. Plans have been prepared and estimates made.

PALO ALTO, CAL.—The town clerk writes us that the proposition to issue bonds for sewers was defeated March 23 by a small majority.

GARBAGE DISPOSAL.

WASHINGTON, D. C.—Specifications have been completed for the collection of garbage during the ensuing year. The bids must state a gross sum (1) for the collection of garbage and dead animals, (2) for the disposal of the same, and (3) for the collection and disposal.

INDIANAPOLIS, IND.—The board of public works proposes to buy up the contracts of the garbage collector and the deslecating company and to arrange the matter of garbage disposal on an entirely new basis. A 90 days' option has been secured on the plant of the Indianapolis Deslecating Co., at $13,000.

DETROIT, MICH.—The city comptroller received two bids for the 3-year garbage contract: The Detroit Sanitary Works, the present contractors, at $50,000 a year, and the Detroit Garbage Crematory Co., at $49,500 a year. The Detroit Garbage Crematory Co. was organized by H. A. Chamberlain, O. S. Harger, Alexander L. Patrick and other local capitalists for the purpose of making this bid. If the company receives the contract it is stated that bids will be asked at once for the construction of a plant, to cost $8,000 or $10,000, where the garbage will all be cremated and none utilized for other purposes.

STREETS AND ROADS.

BOSTON, MASS.—Bids are asked by the water board until April 20 for constructing two portions of the Framingham-Marlboro road in Southboro. The work will consist of 34,700 cu. yds. of earth excavation, 150 cu. yds. rock excavation, 300 cu. yds. dry rubble masonry, and 19,840 lin. ft. of stone wall.

SOMERVILLE, MASS.—The council has adopted an ordinance requesting the mayor to petition the legislature for authority to borrow $50,000 for paving a portion of Medford St.

NEWPORT, R. I.—The citizens have voted to issue $100,000 in bonds for asphalt paving in Thames St., estimated to cost $17,000, and for improving two roads, estimated to cost $23,000, etc.

BINGHAMTON, N. Y.—It is proposed to macadamize two streets.

BROOKLYN, N. Y.—Bids are asked until April 22 for paving Bancroft St. with cobblestones. A. T. White, Comr. Cy. Wks.

BROOKLYN, N. Y.—Bids are asked until April 16 for granite paving blocks and other supplies for the Brooklyn navy yard. Edwin Stewart, Paymaster Gen., U. S. Navy, Washington, D. C.

BUFFALO, N. Y.—Bids are asked until April 18 for paving portions of two streets. R. G. Parsons, Secy. Dept. Pub. Wks.—The board of public works has opened the following bids for paving Washington St., 42 ft. wide from Swan to Exchange St.: Barber Asphalt Paving Co., Trinidad Lake asphalt, $7,387; Buffalo Paving Co., bituminous rock, $7,290, and Medina sandstone, $8,075; P. B. McNaughton, Medina sandstone, $8,494, and Hornellsville brick, $6,494; German-Rock Paving Co., asphalt, $7,391.

NEW YORK, N. Y.—Bids are asked by the commissioner of public works until April 17 for grading and improving portions of four streets, and by the commissioner of street improvements, 2622 Third Ave., until April 17 for paving portions of three streets with granite blocks and grading and improving three other streets.

STAPLETON, N. Y.—The board of supervisors has voted to issue $340,000 in bonds for roads. Henry P. Morrison, Engr.

ATLANTIC CITY, N. J.—The paving of Atlantic Ave. is being considered.

CAPE MAY, N. J.—An ordinance is before the council authorizing an issue of $10,000 in bonds for improvements.

JERSEY CITY, N. J.—The commissioners are considering the question of extending Mercer St. from Brunswick St. to the Boulevard, estimated to cost about $30,000. The work will begin as soon as possible.—It is proposed to open and extend West Side Ave. to Danforth Ave.

MORRISTOWN, N. J.—Bids are asked until April 16 for grading and paving about 100 miles of roads in Morris county with Telford macadam, according to a press report. It is reported that about 2,000 men will be employed. Consult. Engr., Gen. Roy Stone; Wm. B. King, County Engr.

NEWARK, N. J.—The board of public works has been petitioned to pave Summer Ave. with Trinidad Lake asphalt and St. Francis St. with granite blocks.

WEEHAWKEN, N. J.—Bids are asked until April 13 for 4,200 sq. yds. of 6-in. macadam pavement and 2,400 lin. ft. of 4-in. curb at Hauxhurst, Weehawken. Engr., John C. Payne, Fuller Bldg., Jersey City.

BRIDGEPORT, PA.—It is reported that this place will borrow $7,000 with which to improve the streets.

PHILADELPHIA, PA.—The following bids were received March 31 by the bureau of yards and docks, Washington, D. C., for paving the east dry dock pier and approaches at the League Island navy yard:

B. F. Streeter & Son, Trenton, N. J.	$10,082
P. McManus, Philadelphia (awarded contract)	9,994
Barbour & Ireland, Philadelphia	10,442
Justin McCarthy, Washington, D. C.	18,702
William A. Mundy, Philadelphia	11,477
The Mack Paving Co., Philadelphia	10,972
Ervin E. Hodge, New York	14,360
Gus A. Gieger, Philadelphia	10,340
Joseph B. Toner, Germantown, Philadelphia	11,085
Owen Patterson, Baltimore, Md.	12,945
Geo. W. Ruch, Philadelphia	15,677
Vulcanite Paving Co., Phila., $3.25 per sq. yd.	10,842
William H. Edwards, Philadelphia	13,243
Fletcher & Co., Philadelphia	13,500
M. O'Rourke, New York	10,750
Thomas Cunningham, Philadelphia	10,575
Northern Paving Co., Philadelphia	10,275
Thomas C. Cooper, Philadelphia	11,854

WILKINSBURG, PA.—It is proposed to pave portions of 14 streets at an estimated cost of $100,000.

WILMINGTON, DEL.—The commission has recommended the council to issue $250,000 in bonds for improving streets and building sewers.

BALTIMORE, MD.—Bids are asked until April 22 for furnishing Belgian blocks, flagstones, cobblestones, iron gutter plates and repairing streets during the year. A. E. Smyrk, Cy. Comr.

WASHINGTON, D. C.—Bids are asked by the district commissioners until April 19 for sheet asphalt and asphalt block pavements.

BENWOOD, W. VA.—Bids are asked until April 20 for grading and paving Main St. with brick. Chas Morgan, Cy. Recdr.

WHEELING, W. VA.—Bids are asked until April 20 for paving Main St. with brick. Thomas Shephard, Mayor.

SOMERSET, KY.—Bids are asked until April 15 for constructing 10,000 lin. ft. of brick sidewalks, including stone curbing, etc., as stated in our advertising columns. J. H. Wheelock, Cy. Clk.

CINCINNATI, O.—Bids are asked by the board of administration until May 6 for paving Kenyon Ave. with granite blocks.

SANDUSKY, O.—Bids are asked until April 13 for constructing such sidewalks as may be ordered during the remainder of the year. A. W. Miller, Cy. Clk.

INDIANAPOLIS, IND.—We are informed that plans have been ordered by the board of public works for asphalt pavements on St. Clair St., from West to Indiana Ave., 1,500 ft.; Capitol Ave., from Ohio to Indiana Ave., 400 ft., and on Central Ave., from Ft. Wayne to 10th St., about 5,000 ft.; for brick on Clifford St., from C., C., C. & St. L. R. R. to Tecumseh St., about 4,000 ft.; for macadam boulevard on Capitol Ave., from Indiana Ave. to 12th St., about 10,000 ft.

TERRE HAUTE, IND.—Bids are asked until May 7 for paving 11th St. C. H. Goodwin, Cy. Clk.

DETROIT, MICH.—Bids are asked until April 20 for constructing roads, concrete walks, etc., at Fort Wayne, Mich. Capt. George Ruhlen, Asst. Q. M., U. S. A., 1688 River St.

CHICAGO, ILL.—Bids are asked until April 17 for improving portions of 10 streets. John McCarthy, Comr. Pub. Wks.

CHICAGO, ILL.—The citizens of the west side have petitioned the legislature for authority to issue $800,000 in bonds for completing the boulevard system. W. S. Elliott, M. McAuley and George Spry are interested.

LAKE FOREST, ILL.—Cyrus H. McCormick is considering the question of improving his property at this place, which comprises about 40 acres. Olmstead & Elliott, of Brookline, Mass., are preparing plans and estimates for the proposed work, which includes the construction of two miles of paved drives.

PEORIA, ILL.—Bids are asked until May 1 for paving five streets with brick, as stated in our advertising columns. Isaac Taylor, Comr. Pub. Wks.

WAUKEGAN, ILL.—H. Thacker, Cy. Clk., writes us that M. S. McCarron, of Detroit, Mich., has been awarded the contract for 15,300 sq. yds. paving with one course of brick, at $20,700.

RACINE, WIS.—The question of paving Main St. with brick, asphalt or wood, estimated to cost about $25,000, is being considered.

ST. PAUL, MINN.—The council has voted to pave Nicollet Ave. with asphalt, brick, granite or cedar blocks.

TACOMA, WASH.—Henry Bucey, of Buenna, is interested in a project for constructing a gravel road 18 ft. wide along the ridge between Tacoma and Seattle, estimated to cost $10,000.

TORONTO, ONT.—It is proposed to pave portions of two streets with asphalt, at an estimated cost of $11,540, and to build concrete sidewalks in Church St., at a cost of $2,325. John Blevins, Cy. Clk.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

CEMENT.—Ottawa, Ont.—Bids are asked by the department of railways until April 30 for 25,000 bbls. of Portland cement.

DREDGING.—Oswego, N. Y.—Bids are asked until May 1 for dredging in harbor of Little Sodus Bay. Capt. Dan G. Kingman.

CHEMICAL ENGINE, ETC.—Montrose, S. Dak.—Bids are asked for a chemical engine and hook and ladder truck, etc. F. C. Malloy, Clk.

STREET SWEEPING—Milwaukee, Wis.—Bids are asked until April 15 for sweeping the paved streets in the city. G. H. Benzenberg, Cy. Engr.

SEA WALL.—Baltimore, Md.—Bids are asked until April 30 for building a sea wall at Fort McHenry. Col. Wm. P. Craighill, U. S. Engr. Office.

BOILERS, ETC.—Newark, N. J.—Bids are asked by the board of education until April 17 for new boilers.

repairing and moving boilers and for building a brick chimney. P. L. Bryce, Secy.

LUMBER AND HARDWARE.—Winnipeg, Man.—Bids are asked until April 25 for a supply of 400,000 to 1,000,000 ft. B. M., of pine lumber, and for a supply of hardware. J. C. Sproule, Chn. Com.

NAVAL SUPPLIES.—Washington, D. C.—Bids are asked until April 16 for sundry supplies for the navy yards in this city, Norfolk, Va., and Brooklyn, N. Y. Edwin Stewart, Paymaster-General, U. S. N.

PHYSICAL LABORATORY—Philadelphia, Pa.—Bids are asked until April 16 for the supply of apparatus and materials for the physical and chemical laboratories of the Girls' Normal School. H. W. Halliwell, Secy., 713 Filbert St.

CONTRACT PRICES.

DREDGING.—Boston, Mass.—The following bids were received by Lieut.-Col. S. M. Mansfield, U. S. Engr., April 2 for dredging in The Narrows, Boston Harbor: Charles H. Souther and Augustus R. Wright, Boston, Mass., 29 cts. per cu. yd. for dredging and $12.50 per cu. yd. for boulders over 6 tons; C. W. Anthony, Fall River, Mass., 41.9 cts. and $20, respectively; Emory R. Seward, Albany, N. Y., 48.5 cts. and $20.

ELECTRIC LIGHTING.—Reading, Pa.—The contract for street lighting for five years has been awarded to the Metropolitan Light & Power Co. as follows: 300 to 500 arc lights, to burn every night and all night at $105 per light per year; incandescent lights, 500 to 700 lights to burn every night and all night at $20.40 per light per year; lighting the city hall, $720 per year.

DAM, ETC.—Cambridge, Mass.—L. M. Hastings, Cy. Engr., informs us that the following bids were received March 25 for constructing 5,400 ft. of dam and roadway on the line of Winter St., in Waltham, as advertised in Engineering News:

Items.	G. & J. W. Holler, 19 Lexington Av.	Thos. Reilly, 107 Phillip St.	Henry Dunnary, 303 Clinton Ave.	Robt. H. Strong, 296 Washington Ave.	P. W. Mullderry, 5 St. Joseph's Terrace.	Pidgeon & Co., 35 Quay St.
Granite blocks, per sq.yd.	$2.93	$3.06	$2.89	$2.92	$3.17	$2.74
Curbing, per lin. ft.	1.10	1.25	1.15	1.15	1.20	1.45
Circular curb, per lin. ft.	1.38	1.50	1.15	1.65	1.25	1.80
Crosswalk, per sq. ft.	.15	.30	.27	.48	.70	.39
Repairing, per sq. yd.	.40	.30	.61	.40	.18	.25
Resetting old curb, lin. ft.	.03	.20	.41	.07	.18	.15
Brick sidewalks, pr. sq. ft.	.05	.05	.07	.05	.08	.09
Flag sidewalks, per sq. ft.	.14	.13	.15	.14	.16	.20
Sod, per sq. ft.	.16	.04	.07	.02	.04	.10
Receiving basins, each	70.00	85.00	65.00	70.00	75.00	60.00
Cr., cobblestones, sq. yd.	.32	.05	.03	.04	.025	.02
Total	$10,415		$10,491		$12,109	
Total		$11,205		$10,876		$10,941

DREDGING.—Montgomery, Ala.—The following bids were received by Maj. F. A. Mahan, U. S. Engr., March 23 for dredging in Apalachicola Bay, Fla.: Rittenhouse-Moore Dredging Co., Mobile, Ala., 30 cts. per cu. yd.; Jas. A. Bryan, Tampa, Fla., 29½ cts.

Columbus Bridge Co., $2,460; Youngstown Bridge Co., $2,500; Chicago Bridge & Iron Co., $2,550; Toledo Bridge Co., $2,661; Massillon Bridge Co., $2,787; Groton Bridge & Mfg. Co., $2,900; Rochester Bridge & Iron Works, $2,917; Wrought Iron Bridge Co., Canton, O., $2,950; Detroit Bridge & Iron Works, $2,996; Louisville Bridge & Iron Works, $3,300.

STONE PAVING.—Albany, N. Y.—The contract for paving Livingstone Ave., between Broadway and Ten Broeck St., with granite blocks has been awarded to Geo. Holler and Jacob W. Holler, Jr., the bids being as follows; all bidders residents of Albany:

DREDGING.—Wilmington, Del.—Wm. F. Smith, U. S. Agt., writes us that the following bids were received April 5 for dredging, as advertised in Engineering News, the price being per cubic yard, measured in place:

	cts.
American Dredging Co., Philadelphia, Pa.	21.4
Frank E. Somers, Camden, N. J.	25.0
Chester T. Caler, Norfolk, Va.	21.3
Virginia Dredging Co., Richmond, Va.	21.0
Baltimore Dredging Co., Baltimore, Md.	19.8

ELECTRIC LIGHTING.—Sandy Hill, N. Y.—The board of trustees have been authorized to contract for lighting the streets of the village by electricity for five years from the expiration of the present contract, at a cost of $84 per year per arc light of 2,000 c. p. each, each light to burn every dark night of the year from dusk to dawn.

FLAGGING.—Newark, N. J.—Ernest Adams writes us that the following bids were received March 28 for laying and relaying flagging; (1) being price per square foot for 600 lin. ft. of flagging 6 ft. wide, and (2) price per square foot for relaying 400 lin. ft. of flagging 4 ft. wide:

	1. cts.	2. cts.
Newark Bluestone Co. (awarded contract)	14¾	2
Andrew Harper	17	2½
Frank Burkhard	18¾	2½
Van Steenburgh & Clark	20	3½
John Hunkele	20	4
Frank Aulenbach	21	5

BIDS RECEIVED AT CAMBRIDGE, MASS., MARCH 25, 1895, FOR BUILDING WINTER ST. DAM AND ITS APPURTENANCES.

Quantities.		Standard Const'n & Supply Co., Easton, Pa.	McNiece, Crozzo & Co., 35 Broadway, N. Y.	R. A. Malone, 10 Pemberton Square, Boston.	A. H. Coon, Kingston, Pa.	Troy Public Wks. Co., Troy, N. Y.	Weand & Lesher, Reading, Pa.	Smith & McCormick, Easton, Pa.	Edward Gorman, Brooklyn, N. Y.	Chas. Linehan, Cambridgeport, Mass.	F. C. O'Rielly & Co., New York.	Gennaro, Long & Little, South Braintree.	Leavitt & Saucier, Boston.	Thos. F. Maney & Co., Quincy Pt., Mass.	Rowe & Hall, Boston.	Wm. H. Magee, W. Newton, Mass.	F. L. Allen, Worcester, Mass.
Surface excavation	32,000 cu. yds.	$0.29	$0.25	$0.30	$0.31	$0.30	$0.20	$0.25	$0.25	$0.28	$0.25	$0.26	$0.25	$0.42	$0.30	$0.30	$0.35
Trench excavation	7,000 " "	.33	.45	.50	.48	.70	.60	.95	.50	.70	1.00	.90	1.10	2.50	1.50	1.50	1.25
Rock excavation	400 " "	.90	1.75	1.00	2.19	3.00	1.00	2.00	4.00	5.00	2.50	2.50	2.50	4.00	2.00	10.00	7.50
Timber	20 M. ft. B. M.	30.00	20.00	20.00	19.00	20.00	20.00	.25	.35	9.00	25.00	20.00	15.00	20.00	10.00	30.00	12.00
Filling on dam	65,000 cu. yds.	.38	.32	.30	.38	.35	.47	.42	.33	.37	.30	.41	.42	.42	.40	.45	.87
Roadway filling	23,000 " "	.30	.27	.30	.29	.30	.25	.30	.25	.27	.28	.29	.30	.42	.34	.25	.40
" surfacing	4,000 " "	.36	.40	.60	.36	.50	1.50	2.10	.60	.34	.30	.60	.50	.42	1.25	.25	1.00
Loam	3,000 " "	.35	.26	.30	.38	.35	.25	.50	.40	.39	.30	.36	.32	.30	.30	.20	.35
Sodding	6,000 sq. "	.09	.25	.20	.15	.25	.15	.25	.40	.28	.12	.30	.70	.10	.27	.27	.45
Seeding	52,000 " ft.	¼c.	½c.	.01	¼c.	¼c.	.02	½c.	¼ to ½c.	¼ to ½c.	½c.	.02	.01½	.05	¾c.	.01	½c.
American cement	500 bbls.	1.21	1.25	1.40	.90	1.40	1.25	1.50	1.40	1.40	1.50	1.15	1.20	1.50	1.32	1.50	1.25
Portland "	100 " "	2.52	2.50	2.60	2.50	3.00	2.55	3.00	3.00	2.75	2.75	2.90	2.40	3.00	2.58	2.75	2.75
Concrete core wall	7,500 cu. yds.	3.25	4.80	5.00	5.18	4.50	5.50	4.50	4.50	5.00	4.75	4.50	5.25	5.50	5.46	6.50	5.15
American concrete	200 " "	3.10	5.00	5.00	5.18	5.00	6.00	4.90	4.75	5.00	5.75	5.00	6.25	6.00	5.46	6.50	5.00
Portland "	300 " "	4.75	6.50	6.75	6.18	7.00	6.50	6.40	6.50	6.50	6.00	7.00	7.50	7.00	7.76	8.00	7.00
Plastering	4,000 sq. "	.27	.28	.35	.38	.35	.30	.45	.35	.35	.50	.35	.85	.60	.45	.50	.65
Slope paving (granite)	2,000 cu. "	9.07	3.75	5.50	3.20	7.00	3.15	4.65	9.25	6.50	8.00	9.00	7.00	4.00	7.47	7.00	6.75
" " (quarry stone)	2,000 " "	2.64	3.75	3.00	2.42	3.00	2.90	3.00	5.00	3.50	6.00	5.00	6.00	2.50	5.50	6.00	3.90
" " (field stone)	3,300 " "	1.10	2.50	1.00	2.13	2.00	1.50	2.00	2.50	2.25	2.00	2.25	2.25	1.00	3.00	2.00	2.00
Broken stone	2,500 " "	.89	1.70	1.00	1.55	1.00	1.20	2.00	1.70	2.00	2.50	2.75	2.00	2.00	1.43	1.75	1.50
Brick masonry (American cem.)	100 " "	10.06	11.00	10.50	10.77	13.00	10.50	15.00	10.00	13.50	11.00	14.00	20.00	16.00	16.10	18.00	13.00
" " (Portland cem.)	100 " "	10.29	13.00	12.00	11.64	15.00	12.50	16.00	11.50	16.00	12.00	16.00	21.50	18.00	18.40	20.00	15.00
Asphalt	600 sq. ft.	.25	.15	.40	.19	.20	.07	.10	.20	.05	.25	.15	.06	.30	.29	.10	.10
Catchbasins	12	13.20	15.00	80.00	48.80	10.00	25.00	18.00	12.00	25.00	75.00	30.00	15.00	.30	25.00	40.00	30.00
Vitrified pipe	300 lin. ft.	.28	.30	.60	.24	.40	.55	.40	.30	.40	.75	.20	.30	.80	.35	.40	.30
Plumber's pipe	100 " "	.50	1.00	1.30	.59	.60	1.00	1.00	1.00	.60	1.50	1.00	1.25	1.50	1.03	.80	1.50
Rubble masonry (ledge stone)	30 cu. yds.	2.75	5.50	4.00	4.85	6.00	5.00	5.00	6.00	3.50	4.00	4.50	4.00	5.00	5.00	4.00	3.50
" " (granite)	80 " "	9.59	7.00	7.00	5.82	8.00	6.50	8.50	9.50	6.50	9.00	7.00	8.00	7.00	8.62	7.00	6.50
Ashlar "	350 " "	15.81	15.00	14.00	6.79	10.00	16.00	10.00	16.50	20.00	18.00	18.00	18.00	16.00	18.00	18.00	23.00
Dimension masonry	10 " "	47.71	23.00	25.00	29.00	30.00	35.00	25.00	23.00	25.00	30.00	30.00	25.00	40.00	23.00	25.00	23.00
Coping stone	25 " "	18.54	20.00	20.00	26.00	30.00	38.00	19.00	25.00	20.00	20.00	45.00	18.00	40.00	23.00	18.00	15.00
Six-cut work	300 sq. ft.	1.10	.40	.50	.36	.50	.40	.50	.60	.50	.75	1.00	.65	.60	57	.65	.70
Fine pointed work	200 " "	1.10	.35	.30	.34	.50	.30	.30	.45	.40	.60	1.00	.50	.50	.46	.50	.60
Iron work	9,000 lbs.	.05	.045	.04	.03	.08	.05	.10	.09	.05	.03	.04	.08	.08	.07	.06	.04
Flash boards	3 sets.	16.50	15.00	30.00	24.00	10.00	10.00	15.00	10.00	20.00	25.00	50.00	12.00	25.00	30.00	20.00	15.00
Brick paving	100 sq. yds.	.88	2.00	3.00	2.19	2.00	.80	2.75	.65	2.50	3.00	5.00	1.25	7.00	2.30	1.25	2.00
Composition rungs	100 lbs.	.28	.05	.20	.08	.10	.04	.12	.14	.15	.20	.05	.20	.20	.23	.06	.25
Total		$116,273	$122,605	$122,275	$123,737	$129,180	$134,341	$138,208	$138,572	$139,382	$141,015	$151,180	$158,717	$150,615	$168,896	$171,136	$189,025
Transportation	7,500 net tns.	.50	.40	.50	.50	.50	.10	.35	.40	.50	.50	.75	.50	.50	.45	.60	.75

BRICK PAVING.—Council Bluffs, Ia.—S. L. Etnyre, Cy. Engr., writes us that a contract for 5,000 sq. yds. of paving with vitrified brick has been awarded to E. A. Wickham, Council Bluffs, at $1.25 per sq. yd.

CEMENT.—Montgomery, Ala.—We are informed that the following bids were received by Maj. F. A. Mahan, U. S. Engineer Office, March 23, for furnishing and delivering at Wetumpka, Ala., 10,000 bbls., and at Lincoln, Ala., or Lock No. 3, Ala., 8,000 bbls., more or less, of Portland cement:

Bidder.	Brand.	Price of delivery at Lock No. 3, Coln.	Wetumpka. For Lock 4.	Lock 31.
Atlas Cement Co.	"Atlas"	$3.20	$3.02	$2.82
James Brand	"Burham"	....	2.90	2.75
" "	"Josson"	....	3.05	2.90
Sinclair & Babson	"Alsens"	3.08	2.89	2.72
C. M. Gilbert & Co.*	"Gibbs"	2.87	2.77	2.52
" " " "	" **	2.92	2.82	2.57
" " " "	"Aalborg"	2.92	2.82	2.57
E. Thiele	"Dykerhoff"	3.52	3.29	3.14
" "	"Henry"	3.02	2.79	2.64
Manh't'n Cem. Co.	"Ger. German"	3.17	2.93	2.77

* Savannah, Ga.; all others New York, N. Y.
** Double ground.

BRIDGE.—Indianapolis, Ind.—A contract was awarded to the New Columbus Bridge Co., of Columbus, O., on April 6, for a bridge on Spruce St., over Pogue's Run, of the following dimensions: Girders, 75 ft. span by 7 ft. 6 ins. depth by 7-16 in.; floor beams, 30 ft. × 36 ins. × 5-16 in.; I-beams, 15 ft. 6 ins. × 12 ins. × 38.21 lbs. per ft.; present floor double 1½ ins. oak plank; live load, 100 lbs. per sq. ft.; dead load, an asphalt pavement and weight of bridge. The bids were as follows: J. D. Adams & Co., Indianapolis, $2,170; Nelson & Baillie, Indianapolis, $2,298; New

GRADING.—St. Louis, Mo.—Pitzman's Co. of Surveyors and Engineers, 615 Chestnut St., received the following bids for grading 900,000 cu. yds., as advertised in Engineering News: E. J. Scott, 10.23 cts. per cu. yd.; Kinsey & Sons, 12 cts.; R. M. Quigley & Co., 13.69 cts.; Mason, Hoge & Co., 29 cts.; R. H. McWilliams & Co., 13.7 cts.; E. D. Phelan, 9.49 cts.; Befontaine & Barrett, 12.5 cts.; Rothwell Bros., 11.23 cts.; M. S. Carter & Co., 18.5 cts.; Wm. Ryan, 11.4 cts.; Michael Hanick, 10.98 cts.; Jas. Carroll, 12 cts.; Penney-Myers Const'n Co., 10.87 cts.; L. W. Webb, 10.85 cts.; H. Hall & Co., 9.18 cts.; J. A. Ware, 13 3-13 cts.; J. A. Smith, 10.3 cts.; Berry & Dean, 10.45 cts. The above prices are for regular grading. E. J. Scott also bid 10.23 cts. for grading by hydraulic system, and was awarded the contract, the work to be done in that way. Only one other bid was received for work by hydraulic system, and that was rejected.

ASPHALT PAVING, ETC.—Indianapolis, Ind.—Bids were opened March 28 for grading and graveling the roadway and sidewalks of 17th St., total width 50 ft. Prices ranged from 68 to 47 cts. per lin. ft. of each side of the street, and the contract was let to Geo. W. McCray at 47 cts. Bids were opened March 30 for asphalting Clifford Ave.; one section 2,460 ft. long and 35 ft. wide, having 10,598 sq. yds. of surface, about 5,000 ft. of curb, and about 950 ft. of one side is in front of the U. S. Arsenal. The Western Paving & Supply Co. bid $7.73 per lin. ft. of each side, and agreed to assign the claim against the U. S. Government to the city for the benefit of the property holders. The Indiana Bermudez Co. offered to lay the pavement for $6 per lin. ft. if the city would agree to pay the claim against the government if it could not be collected in one year. All bids were rejected. A second section lay opposite Woodruff Place, and the city asked for bids to pave the north half of the roadway, the south half being in the town of Woodruff Place. This section is 1,240 ft. long and 17.5 ft. wide, and has 2,615 sq. yds. of surface and about 1,400 ft. of curb. The bids ranged from $5.00 to $5.80 per lin. ft., and were from the Western Paving & Supply Co., the Warren-Scharf Asphalt Paving Co. and the Indiana Bermudez Co. All the bids were rejected.

BRIDGE SUPERSTRUCTURE.—St. Paul, Minn.—Geo. L. Wilson, Asst. Cy. Engr., informs us that the following bids were received April 2 for the superstructure for the Como Ave. bridge over the Great Northern Ry. tracks:

Bidder.	Steel and iron work, 1,000,000 lbs.	W'den sidewlk., 650 lin. ft.	Oak timb'r, w'k, 2 M. ft. B. M.	Asphalt pav'm't, 1,320 sq. yds.	Sidewalk rail-ing, 704 lin. ft.	Total.
Am. Bridge Works[1]	$0.0261	$1.00	$50.00	$2.45	$1.85	$31,386
Chicago B. & I. Co.	.0285	1.25	50.00	3.00	2.00	34,780
Edge Moor Bdg. Co.[2]	.0270	.90	35.00	2.50	1.75	32,187
Gillette-Herzg Mfr.Co.[3]	.0264	.675	25.00	2.40	1.44	31,189
King Bridge Co.[4]	.0285	.85	30.00	2.48	1.50	33,442
LaFayette Bdg. Co.[5]	.0324	1.50	50.00	2.45	1.00	37,413
Lassig Bridge Co.[1]	.0318	1.10	50.00	2.60	1.90	37,385
N. J. Steel & I. Co.[6]	.0300	.80	30.00	2.48	1.60	34,980
Penn Bridge Co.[7]	.0284	.60	25.00	2.45	1.34	33,017
Pittsburg Bridge Co.[8]	.0298	.90	28.00	2.55	1.80	32,074
Shiffler Bridge Co.[9]	.0296	.65	18.00	2.45	1.60	34,419
C. L. Strobel, Chicago	.0289	1.10	45.00	2.50	1.60	34,131
Wis. Bridge & I. Co.[9]	.02563	1.10	49.50	2.75	1.58	31,186
Wr't. Iron Bdg. Co.[10]	.0290	.70	30.00	2.45	.90	34,382

[1] Chicago. [2] Wilmington, Del. [3] Minneapolis. [4] Cleveland, O. [5] Lafayette, Ind. [6] Trenton. [7] Beaver Falls, Pa. [8] Pittsburg. [9] Milwaukee. [10] Canton, O.

GRADING AND MACADAMIZING.—Washington, D. C.—The following lowest bids were received April 5 for grading, gravelling and macadamizing suburban streets and roads: Lynn Brothers, for macadamizing with quartz the road from Broad Branch road to Chevy Chase circle, at 53 cts. per cu. yd.; M. McNamara, for macadamizing the same road with other than quartz, at 46 cts. per cu. yd.; Langhorn, Allen &

these roads, at 22 cts. per cu. yd.; Laughorn, Allen & Co., for grading Massachusetts Ave., extended, at 26 cts., with a guarantee to finish it in 120 days; M. F. Talty, for grading Kenesaw Ave., between 15th St. and Zoological Park, at 10 cts. per cu. yd., time 120 days; also for grading the streets in the Meridan Hill subdivision, at 24 cts. per cu. yd., time 180 days; Condron & Frawley, for grading Spring St., Anacostia, at 17¼ cts. per cu. yd, time 50 days.

BRICK PAVING.—Cincinnati, O.—A. P. Butterfield, Clk. Bd. of Administration, writes us that the lowest bid received March 23 for paving Congress Ave., from Little Miami Ry. to Kellogg Ave., with brick was that of Henkle & Sullivan, of Cincinnati, itemized as follows:

Curbing	1,100	lin. ft.	at $ .50.....	$ 550
" circular	100	"	" 1.00.....	100
" reset	500	"	" .06.....	30
Grading	2,500	cu. yds.	" .01.....	25
Brick paving	2,800	sq. yds.	" 1.00.....	2,800
Concrete	467	cu. yds.	" 2.90.....	1,354
Rolling	4,100	sq. yds.	" .04.....	164
Macadam	400	cu. yds.	" 1.00.....	400
Gutters repaved	500	lin. ft.	" .10.....	50
				$5,473
Estimated cost				9,483

CAST IRON PIPE.—Buffalo, N. Y.—The contract for supplying the cast iron water pipe needed by the bureau of water during 1895 has been awarded to the Buffalo Cast Iron Pipe Co., at $18.50 a ton for all sizes of pipe.

FILTER BEDS.—Boston, Mass.—The contract for constructing filter beds near Marlboro Junction has been awarded to John Barry, at $3,950, the bids being as follows, the items being (1) 10,000 cu. yds. earth excavation; (2) 1,500 sq. yds. riprap; (3) 240 sq. yds. paving; (4) 70 cu. yds. concrete; (5) 100 cu. yds. borrowed gravel:

	1.	2.	3.	4	5.
Rowe & Hall....	$0.33	$0.90	$3.25	$6.00	$0.40
John Barry.....	.23½	.65	1.50	5.00	.35
Wm. H. Magee.	.30	.60	1.00	5.00	.75
John Shay	.27	.75	2.00	5.00	.50
P. H. Byron....	.45	1.05	1.90	4.75	1.00
Patrick Fahey ..	.28	.68	2.00	6.00	.50
A. Michellini and Jos. Cenerella...	.32	.50	1.50	5.00	1.00
Neil McBride...	.23	.80	2.00	4.50	.40

METAL MARKET PRICES.

LEAD.—New York: 3.1 to 3.12 cts. Chicago: 2.95 to 2.97 cts. St. Louis: 2.92 to 2.95 cts.

NAILS.—Pittsburg: 90 cts. for wire, and 80 cts. for cut at mill in carload lots.

BARBED WIRE.—Pittsburg: galvanized, $1.90; plain, $1.20 for carloads at mill.

FOUNDRY AND PIG IRON.—New York: $10.50 to $12.50. Pittsburg: $9.50 to $10.75. Chicago; $9.50 to $10.50.

TRACK MATERIAL.—New York: angle bars, 1 to 1.1 cts.; spikes, 1.45 to 1.6 cts.; track bolts, 1.75 to 1.85 cts. with square, and 1.9 to 2 cts. with hexagon nuts. Chicago: angle bars, 1.17 to 1.25 cts.; spikes, 1.6 to 1.7 cts.; track bolts, 1.9 to 2 cts., with hexagon nuts.

RAILS.—New York: $22 at eastern mills and $22.75 at tidewater; old rails, $11.50 to $12 for iron, and $10 to $10.50 for steel; steel rails fit for relaying, $14; light rails, $20 to $22; girder rails, $24. Pittsburg: $22 for standard sections of 45 lbs. and over; $23 for light sections; old rails, $12.50 for iron and $10 for steel. Chicago: $23 for standard sections; $25 for light sections; old rails, $11 for iron, and $7.50 to $9.50 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.3 to 1.5 cts.; channels, 1.35 to 1.5 cts.; angles, 1.2 to 1.35 cts.; tees, 1.4 to 1.6 cts.; universal mill plates, 1.2 to 1.35 cts.; steel plates, 1.2 to 1.3 cts. for tank, 1.35 to 1.45 cts. for shell, 1.5 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 2.5 cts. for locomotive firebox. Pittsburg: beams, 1.2 to 1.5 cts.; channels, 1.2 to 1.5 cts.; angles, 1.05 to 1.15 cts.; tees, 1.2 to 1.25 cts.; universal mill plates, 1.05 to 1.15 cts.; steel plates, 1.15 to 1.2 cts. for tank, 1.2 to 1.25 cts. for shell, 1.25 to 1.3 cts. for flange, 1.75 to 2 cts. for ordinary firebox, and 2 to 4 cts. for locomotive firebox. Chicago: beams, 1.4 to 1.45 cts; channels, 1.4 to 1.45 cts.; angles, 1.2 to 1.3 cts.; tees, 1.55 to 1.6 cts.; universal plates, 1.2 to 1.3 cts.; steel plates, 1.25 to 1.35 cts. for tank, 1.5 to 2 cts. for flange, 2 to 4.5 cts. for firebox.

INDUSTRIAL NOTES.

THE JOHNSON CO. started its new Bessemer steel works at Lorain, O., on April 1.

THE LACLEDE CAR CO., of St. Louis, Mo., has the contract for 40 cars for the Buffalo Ry.

THE UNION SWITCH & SIGNAL CO. has removed its Chicago office to the Monadnock Block.

THE WHITING FOUNDRY EQUIPMENT CO. has removed its Chicago office to the Monadnock Block. The Gen. Agt. is Mr. S. T. Johnston.

THE ADAMS & WESTLAKE CO., of Chicago, Ill., states that it is in no way connected with the Union Brass Mfg. Co. which has recently failed.

THE DONALDSON IRON CO., of Emaus, Pa., is reported as having enlarged its force of men and to be pushing work on an annex to its cast iron pipe mill.

THE CRANE CO., of Chicago, has been awarded contracts for furnishing the hydrants for the new water-works at Ashland, O., and Galoa, Ill. Mr. J. B. Berryman is Manager of the water-works supply department.

THE NATIONAL SWITCH & SIGNAL CO., of Easton, Pa., has been awarded the contract for interlocking the new terminals of the Brooklyn Elevated R. R., at High St., Brooklyn, and will also instal a plant for the Manhattan Beach Division of the Long Island R. R.

THE MURRY IRON WORKS, of Burlington, Ia., has enlarged its boiler shop to 104 × 126 ft., and put in a hydraulic riveting machine, with a reach of 10 ft. 7 ins., and has also erected an iron building, 116 × 30 ft., with a 10-ton traveling crane, for use as an erecting and shipping shop.

THE GRIFFIN WHEEL CO. is pushing the construction of its new works at Denver, Colo., which will have a capacity of 200 wheels per day. There will be a foundry building 300 × 104 ft., a machine shop 80 × 75 ft., and core house 60 × 40 ft., all of brick. The machinery will be run by a 200-HP. engine. The works will cover 15 acres.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has built a new boiler house, with anti-condensation roof, for the Hartford Gas Light Co. (Gen. John P. Harbison, Gen. Man.), of Hartford, Conn. The company is also putting up for the New Jersey Magnetic Concentrating Co. a new dryer plant, at Lyon Mountain, N. Y., which will be entirely of iron.

RIDSDALE & LEWIS, of 39 Cortlandt St., New York, have completed two portable electric light plants of 30 arc lights of 2,000 c. p. each, for the Buffalo Bill Wild West Co. These plants are to be used on the road. Their compactness will admit of their being used for one-night stands, as the plant complete can be erected and the lights turned on in about an hour and a half.

W. L. STEBBINGS, Monadnock Block, Chicago, has been engaged as consulting engineer at Lake Forest, Ill., to design and build two small bridges and prepare plans and specifications for brick street paving and macadam roads. He is also building a 246-ft. very heavy double-track swing bridge for the Calumet & Blue Island R. R., and is just completing a 600-ft. viaduct for the Chicago Dock Co.

THE GENERAL CONSTRUCTION CO., 77 Columbian Building, San Francisco, Cal., has been organized, to carry on a general contract business. Pres. and Treas., J. F. Sims; Vice-Pres. and Secy., T. Riffle. The latter has been until recently with the Oregon Bridge Co., of Portland, Ore., which is said to have closed up its business upon the completion of its last contract, laying the submerged main across the Willamette River at Portland.

W. L. KELLY, 1105 Security Building, Chicago, Ill., has formed a partnership with C. E. Atkinson, with the firm name of Kelly & Atkinson. Mr. Atkinson has been Superintendent of the F. J. McCain Co. for several years. They will continue to carry on the business established by Mr. Kelly as contractors for the erection of bridges, buildings, roofs, viaducts, elevated railways, etc. Mr. Kelly was recently awarded a contract for building a large coal dock at Duluth, Minn.

THE SECKNER CONTRACTING CO., Trinity Building, Chicago, has recently been awarded the contract for putting in a complete system of water-works for Alexandria, Ind., at a cost of $60,960. Water will be pumped from two wells, each about 450 ft. deep, to a 20 × 100-ft. stand-pipe. It also has a contract for building a grain elevator for A. J. Yost, at Fowler, Ind.; cost, $30,000; also for elevators at Columbus, O., for Leeds & Co., at a cost of $30,000, and one at West Superior, Wis., for Hayes, Chandler & Co., cost, $30,000.

THE ST. LOUIS CAR CO., of St. Louis, Mo., has the contract for 20 combination summer and winter cars for the Federal St. & Pleasant Valley St. Ry., of Pittsburg, Pa. They are to be made with detachable sides and sashes, and with the seats placed crosswise. There will be a center aisle when used as a closed or winter car, but when used as an open car, with the sides and sashes detached, another seat will be placed in the center aisle. There will be seating capacity for 60 passengers when used as an open car, and 40 when used as a closed car.

FRASER & CHALMERS, Chicago, Ill., are now building a 5,000,000-gallon duplex double-acting Riedler pumping engine for the Lincoln Park pumping station at Chicago, Ill. It will have steam cylinders 18 × 28 × 30 ins., with Corliss valve gear. It will have a piston speed of 275 ft. per minute. They also have a contract for three 30 × 36-in. duplex Riedler air compressors for Syracuse, N. Y., making a total of eight already furnished to one firm. They have also furnished an 18 × 20 duplex Riedler compressor to the Michigan Alkali Co., of Detroit, Mich.

THE NATIONAL PAVING EXHIBITION was held at Minneapolis, Minn., during the first week in April, and the following is a list of exhibitors: Alton Paving Brick Co., Alton, Ill.; American Bituminous Rock Co., Louisville, Ky.; Assyrian Asphalt Co., Chicago, Ill.; Athens Brick Co. and Nelsonville Pipe Co., Athens, O.; Anderson Barr Clay Co., Streator, Ill.; Barnard Brick Co., Bellaire, O.; Brunes N. A. Sidewalk Fastening, Minneapolis; Diamond Brick & Tile Co., Kansas City, Mo.; Des Moines Brick & Tile Co., Des Moines, Ia.; Franklin Stone Sidewalk Co., Minneapolis; Harris Bros. (brick), Zanesville, O.; Holman & Brother (brick), Sargent's Bluff; Hetherington, Berner & Co. (brick and asphalt machinery), Indianapolis, Ind.; International Pavement Co. (asphalt), Baltimore, Md.; Imperial Shale Brick Co., Canton, O.; Illinois Supply & Construction Co. (brick), St. Louis, Mo.; A. O. Jones & Co. (brick), Zanesville, O.; Jasper Co-operative Paving Co., Jasper, Minn.; Logan Fire Clay Co., Logan, O.; Milwaukee Cement Co., Milwaukee, Wis.; Minnesota Standard Stone Co., Minneapolis, Minn.; J. C. Murphy & Co. (filler), Columbus, O.; H. W. McDonald & Son (sewer inlets), Galion, O.; Jas. Murray (granite), St. Cloud, Minn.; Northern Granite Co., St. Cloud, Minn.; N. W. Granite Co., Minneapolis, Minn.; Purington Paving Brick Co., Galesburg, Ill.; E. Rothwell (quartzite), Little Falls, Minn.; Royal Brick Co., Canton, O.; Schillinger Bros. (asphalt), Chicago, Ill.; Sommerset & Johnsonburg Brick Mfg. Co., Johnsonburg, Pa.; J. M. Sullivan (Jasper), Minneapolis, Minn.; J. E. Snyder (cedar block), Minneapolis, Minn.; Standard Asphalt Co., San Francisco, Cal.; Warren-Scharf Asphalt Paving Co., Minneapolis, Minn.; Western Bermudez Asphalt Co., Detroit, Mich.; Allen Cammeron (granite), Sauk Rapids, Minn.; And. Walsedt (granite), Sauk Rapids, Minn.; A. Erickson (granite), Sauk Rapids, Minn.; N. W. Granite Co., St. Cloud, Minn.; Anderson & Co. (granite), St. Cloud, Minn.; Lea Noren (granite), St. Cloud, Minn.; Huldr. Carlson & Co. (granite), St. Cloud, Minn.; Swanson & Co. (granite), St. Cloud, Minn.; St. Cloud Granite Co., St. Cloud, Minn.; Jas. Murray (granite), St. Cloud, Minn.; Robt. Ashworth (granite), St. Cloud, Minn.; Nic. Strights (granite), St. Cloud, Minn.; Standard Granite Co., St. Cloud, Minn.

NEW COMPANIES.—Continental Asphalt Co., East St. Louis, Ill.; $2,000,000; Beverly L. Sturgeon, M. G. Thorpe and Louis Alt.

Joliet Limestone Co., Joliet, Ill.; $1,000,000; A. F. Knox, C. H. Talcott and Charles C. Wilcox.

Houston Mill & Elevator Co., Houston, Tex.; $14,000; I. L. Tomkins, R. V. Lane and W. H. Lovell.

Stillaguamish River Improvement Co., Arlington, Wash.; $6,000; E. F. Gierin and J. W. Lysons.

Toledo Rolling Mill Co., Toledo, O.; $50,000; A. W. Houston, J. Lawrence Adams and Nelson Sayer.

Asbestos Mining & Mfg. Co., Albany, N. Y.; $50,000; J. V. L. Percy, H. Armitage, and R. L. Burage.

Yaracuy Navigation Co., Hoboken, N. J.; $600,000; Geo. H. Lambert and Jos. K. Frank, Newark, N. J.

Woodbine Drainage Co., Hainsburg, Pa.; $15,000; John E. Patterson, A. G. Kinsely and John E. Fox.

National Fire Equipment Co., Chicago, Ill.; $500,000; W. S. Dinmuel, George E. Waldo and B. A. Robinson.

Texas Construction Co., Fort Worth, Tex.; $10,000; J. T. Taylor, J. C. Buchanan and Wallace Hendricks.

Rapid Construction Co., Chicago, Ill.; $20,000; Oliver A. Wells, Lawrence Heyworth and George A. H. Scott.

Akron Iron & Steel Co., Akron, O.; $300,000; Daniel P. Wheeler ,Charles E. Sheldon and George W. Plumer.

Struthers Iron & Steel Co., Struthers ,O.; $5,000,000; Jonathan Warner, Jr., James S. Patterson and Louis W. King.

Green Concentrical Furnace Co., Chicago, Ill.; $600,000; Chester B. Davis, Wm. H. McAndrews and Roy S. Bates.

Elba Iron Co., Duluth, Minn.; $100,000; J. H. Chandler, E. L. Merriman, and L. T. Beecher, all of Chicago, Ill.

Standard Air Brake Co., New York, N. Y.; $50,000; Henry Seligman, Edward D. Phillips, and Edward J. Wessels.

Automatic Telephone Co. of Wisconsin, Chicago, Ill.; $500,000; J. H. Theobold, Wm. T. Whipple and Maurice Rosenfield.

Continental Asphalt Co., East St. Louis, Ill.; $1,000,000; Beverly A. Sturgeon, Marshall C. Thorpe and Louis Alt.

Atlantic Quarry & Construction Co., St. Louis, Mo.; $6,000, all paid in; Louis Krainka, Morris Krainka and Michael Harick.

Dustless Railway Car Co., East St. Louis, Ill.; $1,000,000; M. D. Morgan, Thomas Furlong and Thomas Q. Dix.

Eastern Bermudez Asphalt Paving Co., New York, N. Y.; $75,000; W. H. Thomas, Melvin Stephens, and H. B. Vanderhoef.

Automatic Air & Steam Coupler Co., East St. Louis, Ill.; brake hose couplers, etc.; E. J. Mariam, Wm. H. Phelps and H. H. Hess.

American Malleable Iron Co., Latrobe, Pa.; $20,000, with $2,000 paid in. Treas., D. Porter Corwin, 413 Wood St., Pittsburg, Pa.

Oklahoma Sanitarium Co., Guthrie, Okla.; Dr. J. B. Rolater, of Oklahoma City, Okla.; and Dr. T. S. Galraith, of Logansport, Ind.

Wilson & Thatcher Construction Co., Chicago, Ill.; $5,000; general contracting; John Askew, Felix J. Griffin and Robert T. Wilson.

Massachusetts Granite Pressed Brick Co.; $200,000; Pres., Hadson B. Damon, 131 Devonshire St., Boston, Mass.; Treas., Allen Sheldon.

Multiphase Motor Co., New York city; $200,000; Alfred S. Brown and Watson D. Schram, of New York city; G. W. Gardiner, of Nyack, N. Y.

Stanley G. Miller Co., Philadelphia, Pa.; $25,000, with $2,500 paid in; hardware and machinery; Charles W. Miller, The Gladstone, Philadelphia.

Facer Solid Steel Car Wheel Co., Perth, Ont.; $320,000; James A. Facer, of Philadelphia, Pa.; A. T. Wilson and J. M. Balderson, of Perth, Ont.

Trimble & Lutz Co., Wheeling, W. Va.; $200,000, with $500 paid in; hot water and steam heating plant, etc.; G. W. Lutz, J. A. Hess and H. E. Ebbert.

Texas Coast Canal Co., Corpus Christi, Tex.; $500,000; John B. Armstrong, of Alice; A. Boschke, of San Antonia, and Wm. D. Ryee, of Corpus Christi.

Elizabeth Chemical Co., Elizabeth, N. J.; $250,000; Elles T. Pond, Plainfield, N. J.; A. R. Frank and Samuel H. Guggenheimer, New York city.

Pennsylvania Range Boiler Co., Philadelphia, Pa.; $75,000, with $7,500 paid in; Treas., Lawrence B. Levy, 1702 Spring Garden St., Philadelphia.

American Dock & Warehouse Co., New York, N. Y.; $1,500,000; Wm. J. Hardy and Henry Darby, Jr., of New York; C. A. Ward, of Waterbury, Conn.

San Mateo Land Association, San Mateo, Cal.; $100,000, with $80,000 paid in; streets, sewers, etc.; James D. Byrnes, P. M. Roedel and Robert Winsom.

Warren Contracting Co., Jersey City, N. J.; $100,000, with $10,000 paid in; John Quinn and Edwin A. Mallette, of New York; James Raymond, Brooklyn, N. Y.

Martin Pipe & Foundry Co., San Francisco, Cal.; $100,000, with $500 paid in; W. Frank Pierce, of Oakland, Cal.; C. F. Linder and John Martin, of Berkley, Cal.

Barrett Car Fender Co., Jersey City, N. J.; $500,000, all paid in; Charles A. Barrett, Malden, Mass.; Clark B. Dunton, Portland, Me.; M. F. Dickinson, Jr., Boston, Mass.

Warren Contracting Co., 93 Nassau St., New York N. Y.; $100,000, with $10,000 paid in; Pres., John Quinn; Vice-Pres. and Gen. Man., Jas. Raymond; Treas., Edwin A. Mallette.

Enholm Conduit Trolley Co., New York, N. Y.; $5,000,000, with $500 paid in; O. A. Enholm and C. E. Sherin, of New York; G. S. Smith, 1226 Dean St., Brooklyn, N. Y.

Philadelphia, Wilmington & Maryland Construction Co., Philadelphia, Pa.; $100,000, with $10,000 paid in; ships and boats; Treas, Henry Hess, 2544 North 8th St., Philadelphia.

Little Kanawha Development Co., Clarksburg, W. Va.; $500,000, with $500 paid in; oil-pipe lines, etc.; J. B. Hart, of Clarksville, W. Va.; R. W. Offutt, of Burnsville, W. Va.

Interstate Railroad & Telegraph Construction Co., New York city; $5,000,000, with $500 paid in; R. T. Clark, of Bridgeport, Conn.; C A. Troupe and W. G. Lane, of New York.

Vulcan Gas Heating Co., Passaic, N. J.; $300,000, with $1,000 paid in; Geo. H. Patten, Plainfield, N. J.; Fred. H. Mollenhauer, Jersey City, N.J., and Henry S. Roll, Hoboken, N. J.

Standard Telephone Co., Chicago, Ill.; $10,000,000; Pres., Thurlow Weed Barnes. It will operate the patents of Allen T. Nye and W. R. Cole on transmitters and switchboards.